# SECTION 02 41 16 - STRUCTURE DEMOLITION

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. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvage of existing items for the owner, reuse in the project or for recycling.

B. Related Sections:

1. Section 01 50 13 “Construction Waste Management and Disposal” for documenting salvage, recycling, and disposal of nonhazardous demolition and construction waste.
2. Section 31 10 00 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

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

B. Remove and Recycle for the Benefit of the Owner: Carefully detach from existing construction, in a manner to prevent damage, and deliver to a recycling center.

C. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

D. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and install where indicated.

1.4 MATERIALS OWNERSHIP

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

B. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.

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

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and recycled for the benefit of the owner along with a check made out to the School District from the Waste Management Company(ies) for the recycling value received for items removed and recycled.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

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

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.8 PROJECT CONDITIONS

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

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

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.

2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

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

C. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
2. Before building demolition, Owner will remove the following items:

   a. Furniture.
   b. Computers and office equipment.
   c. Educational equipment, books, supplies, and tools.
   d. Appliances.

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

1. The school district will contract with a hazardous material abatement contractor to perform hazardous material remediation.

2. In most cases the hazardous material will be removed by the hazardous material abatement contractor prior to start of work.

3. The contractor is to coordinate their demolition work with the hazardous material abatement contractor to identify additional areas to be removed by the hazardous material abatement contractor.

4. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

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

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Maintain fire-protection facilities in service during demolition operations.

1.9 COORDINATION

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

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

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

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

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 31 20 00 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

B. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

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

3.2 PREPARATION

A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

C. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

D. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

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

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

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

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 4 hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

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

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

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

C. Removed and Recycled Items for the Benefit of the Owner:

1. Carefully remove items to get the best recycled value.
2. Pack or crate items after removal. Identify contents of containers.
3. Store items in a secure area until delivery to Waste Management Company for recycling.
4. Transport items to Waste Management Company.
5. Protect items from damage during transport and storage.
6. Contractor shall remit all funds received from Waste Management Company of items recycled for the benefit of the owner to the owner.

D. Salvage: Items to be removed and salvaged are indicated in Paragraph 3.10.

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

1. Remove below-grade construction, including foundation walls and footings, completely.

F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area, unless otherwise indicated.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 31 20 00 "Earth Moving."
2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 31 20 00 "Earth Moving."

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

3.7 REPAIRS

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

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill and/or recycling center.

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

B. Do not burn demolished materials.

3.9 CLEANING

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

1. Clean roadways of debris caused by debris transport.

3.10 SALVAGED ITEMS RECYCLED FOR THE BENEFIT OF THE OWNER SCHEDULE

A. Existing Items to Be Removed and Recycled for the Benefit of the Owner (unless otherwise noted on the drawings as salvage items or items to be reused in the project.)

1. Chain-link and Wrought Iron Fencing.
2. HVAC Equipment and Fans
3. Electrical Switchgear
4. Electrical Panel Boards
5. Over Current Protection Devices
6. Copper Wire/Conductors
7. Rigid Metal and EMT Conduit
8. Light Fixtures

**END OF SECTION 02 41 16**

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

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Concrete grade beams.
3. Slabs-on-grade.
4. Lean Mix Concrete
5. Exposed concrete slabs-on-grade.
6. Ground-mounted equipment and utility slabs-on-grade.

B. Related Sections:

1. Section 31 20 00 "Earth Moving" for free draining gravel course under slabs-on-grade.
2. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, staining materials, and others as requested by the Architect.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Drawings that detail fabrication, bending, and placement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcement required and openings through concrete structures.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor barrier, and Speed Dowel System.

F. Qualification Data: For Installer and Design Mixture Engineer (California Registered Civil or Structural Engineer).

G. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design tests as specified.

H. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by the Architect. Material certificates shall be signed by manufacturers and contractor, certifying that each material item complies with, or exceeds specified requirements:

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.

1. 2016 California Building Code – CCR Title 24, Part 2.
2. ACI 301 "Specifications for Structural Concrete for Buildings." A registered civil engineer with experience in concrete mix design shall select the relative amounts of ingredients to be used as basic proportions of the concrete mixes proposed for use under CBC Section 1905A.2 and testing shall be performed in a laboratory acceptable to the enforcement agency.
3. ACI 318 "Building Code Requirements for Reinforced Concrete."
4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

D. Concrete Testing Service: The Owner shall employ a testing laboratory acceptable to the Architect to perform material evaluation tests. Design of concrete mixes shall be by a registered civil engineer retained by the Contractor.

E. Materials and installed work may require testing and retesting, as directed by the Architect, at anytime during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at Owner's expense, including re-testing of rejected materials and installed work, shall be paid by Owner, but backcharged to the Contractor.

F. Testing shall be performed per Section 3.16 of these Specifications and CCR Title 24, Chapter 19A.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

D. Forms for Textured Finish (TX-Fn) Concrete: Form textured finished concrete surfaces with units of face design, size, arrangement and configuration as shown on drawings or as required to match Architect's concrete sample. Provide solid backing and form supports to ensure stability of textured form liners.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

F. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

G. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

H. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

I. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

J. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615, Grade 60, deformed, #4 and larger. For #3 use Grade 40.

B. Weldable Steel Reinforcing Bars: ASTM A706, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A706, deformed.

D. Plain-Steel Wire: ASTM A82, plain, cold-drawn, steel.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Slip Dowel System: Greenstreak two component Speed Dowel System to accept #4 x 12” to 24” long slip dowels (see drawings for size at specific details.) The Greenstreak Speed Dowel System is comprised of a reusable base and a plastic sleeve. Both pieces shall be manufactured from polypropylene plastic.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2. For slabs-on-grade, use supports with sand plates on horizontal runners where base material will not support chairs legs.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II (low alkali) unless otherwise acceptable to Architect, gray

B. Normal-Weight Aggregates: ASTM C33, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source. Other aggregates which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Architect and DSA.

1. Maximum Coarse-Aggregate Size: 1 1/2 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Concrete Sand: ASTM C33. Provide concrete sand from a single source.

D. Water: ASTM C94 and potable.

E. Calcium Chloride not permitted.

F. Air-Entraining Admixture: ASTM C 260.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chroride ions exceeding those permited in hardened concrete. Do not use calcium chloride are admixtures containing calcium chloride.

2.5 VAPOR BARRIER

A. Sheet Vapor Barrier: ASTM E1745, Class A, except with maximum perm rating of 0.01 (grains/(ft² · hr · inHg) after mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Stego Industries, LLC; Stego Wrap Vapor Barrier (15 mil).
b. Architect and District approved equal.

B. Vapor Barrier Accessories

1. Seams:

a. Stego Industries, LLC; Stego Tape

2. Sealing Penetrations of Vapor Barrier:

a. Stego Industries, LLC; Stego Mastic
b. Stego Industries, LLC; Stego Tape

3. Perimeter/Edge Seal:

a. Stego Industries, LLC; Stego Crete Claw

4. Penetration Prevention:

a. Stego Industries, LLC; Beast Foot

5. Vapor Barrier-Safe Screed System:

a. Stego Industries, LLC; Beast Screed

C. Free Draining Gravel Course: Specified in Section 31 20 00 “Earth Moving.”

2.6 DECORATIVE GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

2.7 TEMPORARY FLOOR PROTECTION

A. Temporary Floor Protection Membrane: Multi-ply, textured membrane laminated with a non-woven polypropylene geotextile, 18 mils thick. Equal to L.M. Scofield Company; Proguard Duracover.

B. Heavy Duty Seaming Tape: Seaming Tape compatible with Floor Protection Membrane. Equal to L.M. Scofield Company; Proguard Duracover Seaming Tape.

2.8 LIQUID FLOOR TREATMENTS

A. Liquid floor treatments 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."

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating.

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, as specified in ACI 301 and Chapter 5 of ACI 318.

1. Use a qualified independent testing agency, acceptable to Architect, for preparing and reporting proposed mixture designs based on laboratory trial mixtures. The testing shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

2. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

B. Adjustment to Concrete Mixes: Mix design adjustment may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and approved by Architect before using in work.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Reinforced Foundation Systems: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.58.
3. Slump Limit: Not less than 3" and not more than 5".
4. Air Content: Plus or minus 1.5 percent at point of delivery for 1.5-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd.
4. Slump Limit: Ramps and sloping surfaces - not more than 3". All other slabs - not less than 3" and not more than 5".
5. Air Content: Plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished concrete floors to exceed 3 percent.

C. Lean Mix (Sand Slurry): Proportion sand slurry concrete mixture as follows:

1. Minimum Compressive Strength: 50-125 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 2.03.
3. Minimum Cementitious Materials Content: 188 lb/cu. yd (2 sack)
4. Slump Limit: Not less than 3" and not more than 5".
5. Air Content: Plus or minus 1.5 percent at point of delivery for Concrete Sand.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

1. Delete references for allowing additional water to be added to batch for material with sufficient slump. Addition of water to the batch will not be permitted.
2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
3. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

B. Place and secure edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure unites sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place at least 14 days and until concrete has achieved its 28-day design compressive strength. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
2. Form facing material may be removed 4 days after placement only if shores have been arranged to permit removal of forms without loosening or disturbing shores and supports.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces, except as acceptable to Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR BARRIERS

A. Sheet Vapor Barriers: Place, protect, and repair sheet vapor barrier according to ASTM E1643 and manufacturer's written instructions as submitted to and approved by Architect.

1. Unroll Vapor Barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of placement whenever possible.
2. Extend vapor barrier to the perimeter of the slab. At all points of termination (block-outs, interior grade beams, pad footings, perimeter edge, etc.), mechanically seal vapor barrier to the slab itself using Stego Crete Claw, per manufacturer's instructions.
3. Lap joints 6 inches and seal with manufacturer's recommended tape.
4. Apply seam tape/Crete Claw to clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. No penetration of the Vapor Barrier is allowed except for reinforcing steel and permanent utilities.
7. For interior forming applications, avoid the use of non-permanent stakes, driven through the vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot’s peel-and-stick adhesive base is fully adhered to the vapor barrier.
8. If non-permanent stakes must be driven through vapor barrier, repair as recommended by vapor barrier manufacturer.
9. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
10. For a vapor barrier-safe, fixed-elevation concrete screeding application, install Beast Screed (vapor barrier-safe screed system) per manufacturer’s instructions prior to placing concrete.
11. Repair damaged areas by cutting patches of Vapor Barrier, overlapping damaged area 6 inches and taping all four sides with tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install construction joints, which are not shown on drawings, so strength and appearance of concrete are not impaired, as acceptable to Architect.

1. Horizontal construction joints between successive concrete pours shall be properly cleaned by sandblasting 5 days (minimum) after initial concrete placement.
2. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
3. Provide keyways at least 1 1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
4. Locate joints for slabs in the middle third of spans.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Slip Doweled Joints (Speed Dowel System): Install dowel bars and support assemblies at joints where indicated.

1. Attach Speed Dowel System bases to the face of the concrete forms using a double headed nail or self-tapping screw.
2. Center of Speed Dowel System base shall be centered on form. Place edge forms plumb. Out of plumb forms will result in misaligned dowels.
3. Prior to pouring concrete, Speed Dowel System sleeve shall be slipped over Speed Dowel System base.
4. Pour concrete minimum of 18” from Speed Dowel System and work concrete around the Speed Dowel System. Concrete shall not be poured directly over the Speed Dowel System.
5. Concrete forms shall be removed with Speed Dowel System bases still attached. Speed Dowel System based may be reused.
6. Install slip dowels to the full depth of the embedded Speed Dowel System sleeve and proceed with next concrete pour. Greasing of dowels is not required as the embedded

Speed Dowel System sleeve accommodates expansion and shrinkage movements that may occur. Bent or badly sheared slip dowels shall not be used. Saw cut dowels recommended.

3.8 CONCRETE PLACEMENT

A. Preplacement Inspection, Notification: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Notify Architect, Project Inspector, and DSA by email 48 hours in advance of placement. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly (2% maximum slope in all directions) to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas. Do not wet round concrete column forms.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish (RFm-Fn): As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish (SmFm-Fn): As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view**,** to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Grout-Cleaned Finish (GRTCl-Fn): Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, and ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

3. Interior exposed concrete floor slabs shall be slip resistant. Unless otherwise indicated, the static coefficient of friction (COF) shall not be less than 0.6 for level surfaces and 0.8 for ramps, per ASTM C1028-07 and Chapter 11B of CCR Title 24, Part 2, California Building Code as interpreted and enforced by the Division of the State Architect.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Non-Slip Broom Finish: Apply a non-slip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Medium-Textured Broom Finish: Draw a stiff-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, medium-line texture.

   a. Sidewalks and Ramps: Slopes less than 6%.
   b. Stair Treads.

2. Heavy-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

   a. Ramps: Slopes of 6% or greater.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following method:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   a. Removal: After curing period has elapsed and prior to installation of decorative floor treatments and resilient floor covering (rubber tile, sheet vinyl, and carpet), remove curing compound without damaging concrete surfaces by method recommended by decorative floor treatments and resilient floor covering manufacturers (these methods may be different).

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions as submitted to and accepted by Architect.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
4. After final coat is applied and dried, remove surplus treatment by scrubbing and mopping with water.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions as submitted to and accepted by Architect.

1. Defer joint filling until concrete has aged at least **one** month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing laboratory to perform field tests and prepare test reports. Refer to the DSA-103 Structural Tests and Inspections Form at the end of Section 01 45 00 - Quality Control.

B. Waiver of Batch Plant Inspection: Batch plant inspection may be waived under the following condition:

1. The concrete plan complies fully with the requirements of ASTM C94, Sections 8 and 9, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to DSA. The certification shall indicate that the plant has automatic batching and recording capabilities.
2. When batch plant inspection is waived the following requirements shall apply:

a. An approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weighmaster.
b. The licensed weighmaster shall positively identify materials as to quantity and certify each load by a ticket.
c. The ticket shall be transmitted to the project inspector by a truck driver with load identified thereon. The inspector will not accept the load without a load ticket identifying the mix. The inspector will keep a daily record of placements, identifying each truck, its load and time of receipt, and approximate location of deposit in the structure. The inspector will transmit a copy of the daily record to DSA.
d. At the end of the project, the weighmaster shall furnish an affidavit to DSA on form SSS 411-8 certifying that all concrete furnished conforms in every particular to the particular to the proportions established by mix designs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to CBC Section 1905A.1.2, ACI 318 Section 5.6, and ASTM C172 shall be performed according to the following requirements:

1. Testing Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231, pressure method, for normal-weight concrete; **one** test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C31.

   a. Cast and laboratory cure one set of three standard cylinder specimens for each composite sample, unless otherwise directed.

7. Compressive-Strength Tests: ASTM C39; test one of the three laboratory-cured specimens at 7 days and one of the three specimens at 28 days.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, DSA, concrete batch plant, and Contractor on same day that tests are made. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Additional Tests: The testing service shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. If the strength acceptance criteria are not met, the concrete will be deemed defective and shall be placed or adequately strengthened in a manner outlined by the Architect or Structural Engineer.

3.17 PROTECTION

A. The General Contractor is responsible for using TEMPORARY FLOOR PROTECTION throughout the project to safeguard the surface quality of concrete slabs before and after application of decorative finishes or installation of other materials.

B. All concrete floors that will not be covered by other materials shall be protected throughout the project. The concrete slab shall be treated as a finished floor at all times during construction.

C. TEMPORARY FLOOR PROTECTION shall be installed per manufacturer’s published installation procedures. Overlapped seams shall be taped with Heavy Duty Seaming Tape

D. Do not apply the Heavy Duty Seaming Tape to bare or finished floors or wall surfaces at any time. The tape will permanently damage the surface.

3.18 MAINTENANCE

A. Maintain exposed concrete floors by sweeping. Clean spills when they occur and rinse dirt off with water. Wet-clean heavily soiled areas by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent.

**END OF SECTION 03 30 00**

# SECTION 03 52 16 - LIGHTWEIGHT INSULATING CONCRETE SYSTEM (LWIC)

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 cast-in-place cellular lightweight insulating concrete.

B. Related Sections:

1. Section 07 51 13 "Built-up Asphalt Roofing o/ LWIC" for installation of roofing membrane over LWIC.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include mixing and application instructions for each type of lightweight insulating concrete.

B. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses, embedded insulation board, roof penetrations, roof perimeter terminations and curbs, and roof drains.

C. Design Mixtures: For each lightweight insulating concrete mix.

D. Qualification Data: For qualified Installer and testing agency.

E. Product Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Foaming agents.
3. Molded-polystyrene insulation board.

F. Material Test Reports: For lightweight aggregates, from a qualified testing agency, indicating compliance with requirements.

G. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An Installer who employs and retains, throughout the project, supervisors who are trained and approved by manufacturer.

1. A firm that has been evaluated by UL and found to comply with requirements of the National Roof Deck Contractors Association Lightweight Insulating Concrete Roof Deck Contractors (LWIC) Accreditation Program.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. FM Approvals Listing: Provide lightweight insulating concrete evaluated by FM Approvals as part of a roof assembly and listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.6 PROJECT CONDITIONS

A. Do not place lightweight insulating concrete unless ambient temperature is at least 40 deg F and rising.

1. When air temperature has fallen or is expected to fall below 40 deg F, heat water to a maximum 120 deg F before mixing so lightweight insulating concrete, at point of placement, reaches a temperature of 50 deg F minimum and 80 deg F maximum.

B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cementitious Material: Portland cement, ASTM C 150, Type I.

B. Foaming Agent: ASTM C 869.

C. Water: Clean, potable.

D. Molded-Polystyrene Insulation Board: ASTM C 578, Type I, 0.90-lb/cu. ft. minimum density.

1. Provide units with manufacturer's standard keying slots of approximately 3 percent of board's gross surface area.

2.2 DESIGN MIXTURES

A. Prepare design mixtures for each type and strength of lightweight insulating concrete by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs.

1. Limit use of fly ash to not exceed 25 percent of portland cement by weight.

B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.3 CELLULAR LIGHTWEIGHT INSULATING CONCRETE

A. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents, and the minimum amount of water necessary to produce a workable mix.

1. Basis of Design Product: Subject to compliance with requirements, provide **Elastizell Corporation of America; Composite Insulating Roof Deck System** or comparable product by one of the following:

   a. Aerix Industries, Mearlcrete Division.
   b. Celcore Incorporated.
   c. Architect and School District approved equal.

2. As-Cast Unit Weight: 34 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C 138.
3. Air-Dry Unit Weight: 26 to 34 lb/cu. ft. when tested according to ASTM C 796.
4. Compressive Strength: Minimum 160 psi, when tested according to ASTM C 796.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to starting work, any unsatisfactory conditions of related trades shall be corrected before start of LWIC installation.

B. General Contractor shall clear the deck of all standing water, dirt, and debris.

C. Seal seams, joints, and gaps to prevent bleed water and LWIC from penetrating the space below the deck.

**D. Provide stainless steel fasteners for mounting below deck conduits, pipes, hangers, etc., if installed prior to placement of LWIC.**

3.2 MIXING AND PLACING

A. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.

B. Install insulation board according to lightweight insulating concrete manufacturer's written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards.

1. Install insulation board in a stair-step configuration with a maximum step-down of 1 inch.

C. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Plan work to minimize cold joints. Scarify cold joint to provide a mechanical key. Do not vibrate or work mix except for screeding or floating. Place to 2 inches minimum thickness, sloped to drains at ¼ inch per running foot minimum.

D. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.

E. Begin curing operations immediately after placement and air cure for not less than three days, according to manufacturer's written instructions to achieve sufficient surface hardness to adequately withstand foot traffic and other light roofing operations without damage.

F. If ambient temperature falls below 32 deg F, protect lightweight insulating concrete from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.

G. The roof deck shall not be left exposed for longer than 5 to 7 days.

H. Protect the insulating concrete roof deck from construction traffic.

I. Upon completion of the LWIC system, the roofing contractor is responsible for minimizing water entry into the LWIC system and for removing excess water (from rain) from the LWIC system. Follow recommendations for the removal of excess rain water from the system if rain infiltration occurs.

J. The exposed surface and entire LWIC system shall be dry prior to installation of the roof membrane system.

K. Roof membrane shall be installed per Project Manual Section 07 51 13 – Built-up Asphalt Roofing.

L. Clean and remove any LWIC material that penetrates to underside of metal deck within 5 to 7 days of placement.

3.3 FIELD QUALITY CONTROL

A. Testing: Manufacturer shall sample materials, perform field tests and inspections, and prepare test reports.

B. Testing of samples of lightweight insulating concrete obtained according to ASTM C 796, shall be performed according to the following requirements:

1. Determine air-dry unit weight and compressive strength according to ASTM C 796. Make a set of at least four molds sampled at point of placement daily, but not less than one set of molds for each 100 cubic yards of material placed.
2. Perform additional tests when test results indicate that as-cast unit weight, air-dry unit weight, compressive strength, or other requirements have not been met.

   a. Retest cast-in-place lightweight insulating concrete for air-dry unit weight and compressive strength.

3.4 DEFECTIVE WORK

A. Refinish, or remove and replace, lightweight insulating concrete if surfaces are excessively scaled or too rough to receive roofing according to roofing membrane manufacturer's written instructions.

B. Remove and replace lightweight insulating concrete that fails to comply with requirements.

**END OF SECTION 03 52 16**

# SECTION 04 20 00 – UNIT MASONRY

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of each type of masonry work is indicated on drawings and schedule.

B. Provide and install reinforcing steel as required for reinforcing all masonry walls.

1.3 QUALITY ASSURANCE

A. Retain only those persons experienced and qualified for this type of masonry work.

1.4 SUBMITTALS

A. Samples: Submit, for verification purposes, samples of each exposed masonry unit and colored masonry mortar, if any. Include in each set of samples the full range of exposed colors and textures to be expected in completed work.

B. Shop Drawings; Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Shop drawings shall include but not be limited to bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement. Include special reinforcement required and openings through masonry structures.

1.5 JOB CONDITIONS:

A. Protection of Work: During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

F. Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 °F (6 degrees C).

1. 40 °F (4°C) to 32° F (0°C):

   a. Mortar: Heat mixing water to produce mortar temperature between 40° F (4° C) and 120 ° F (49 ° C).

   b. Grout: Follow normal masonry procedures.

2. 32 ° F (0 ° C) to 32 ° F (0 ° C):

   a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 ° F (4 ° C) and 120 ° F (49° C); maintain temperature of mortar on boards above freezing.

   b. Grout: Heat grout materials to 90 ° F (32° C) to produce in place grout temperature of 70 ° F (21 ° C) at end of workday.

3. 25 ° F (-4 ° C) to 20 ° F (-7 ° C):

   a. Mortar: Heat mixing water and sand to produce mortar temperature 40 ° F (4 ° C) and 120 °F (49 ° C); maintain temperature of mortar on boards above freezing.

   b. Grout: Heat grout materials to 90° F (32 ° C) to produce in-place grout temperatures of 70 ° F (21 °C) at end of workday.

   c. Heat both sides of wall under construction using salamanders or other heat sources.

   d. Use windbreaks or enclosures when wind is in excess of 15 mph.

4. 20° F (-7 ° C) and below:

   a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40° F (4 °C) and 120 ° F (49 ° C).

   b. Grout: Heat grout materials to 90 ° F (32 ° C) to produce in place grout temperature of 70 ° F (21 ° C) at end of workday. No grout shall be placed when the atmospheric temperature falls below 20 ° F.

   c. Masonry Units: Heat masonry units so that they are above 20 ° F (-7 ° C at time of lying.

   d. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40° F (4 ° C) for 24 hours after laying units. Do not heat water for mortar and grout to above 160° F (71 ° C).

G. Protect completed masonry and masonry not being worked on in the following manner. Temperate ranges indicated apply to mean daily air temperatures except for grout masonry. For grouted masonry temperature ranges apply to anticipated minimum night temperatures.

1. 40° F (4 ° C) to 32 ° F (0 ° C):

Protect masonry from rain or snow for at least 48 hours by covering with weather-resistive membrane, if Type I & II cement, 24 hours; if Type III.

2. 32 ° F (0 ° C) to 20 ° F (-7 ° C):

For Type III cement, completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours ; 48 hours for grouted masonry or Type I & II cement.

3. 20 ° F (-7 °C and below):

When using Type III cement, except as otherwise indicated, maintain masonry temperature above 32 ° F (0 ° C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry or for Type I & II cement, maintain heated enclosure to 40° F (4 ° C) for 48 hours.

2. PRODUCTS

2.1 MASONRY UNITS, GENERAL:

A. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.

B. Masonry Unit Characteristics: Provide units complying with standards referenced and requirements indicated on drawings.

2.2 CONCRETE MASONRY UNITS:

A. Size: Manufacturer's standard units with nominal face dimensions of:

1. 8 x 16 x 8
2. 12 x 16 x 8

B. Finish:

1. Standard Precision Finish

C. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

D. Weight Classification: Light weight units unless otherwise indicated (105 lbs. per cu. ft. maximum, oven dry weight of concrete).

E. Cure units in a moisture-controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C 90, Type 1.

1. Limit moisture absorption during delivery and until time of installation to the maximum percentage specified for Type 1 units for the average annual relative humidity as reported by the U. S. Weather Bureau Station nearest the Project site.

F. Standards: Comply with CBC Section 2102A.

2.3 MATERIALS:

A. Reinforcing Steel: Specification requirement for reinforcing steel shall be as set forth under Reinforcing Steel elsewhere herein.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color. Use low alkali cement for reactive aggregates.

C. Hydrated Lime: ASTM C-207 Type S.

D. Quicklime: ASTM C-5 high calcium.

E. Lime Putty: Made from high calcium quicklime, slaked before using and properly aged, weighing not less than 83 pounds per cubic foot.

F. Aggregate for Mortar: ASTM C 144, except for joints less than ¼" use aggregate graded with 100% passing the No. 16 sleeve.

G. Aggregate for Grout: ASTM C 404.

H. Colored Mortar Pigments: Natural and synthetic iron oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.

I. Water: CBC Section 2103.A.2.

J. Waterproofing: Mapei "Planiseal 88", trowel applied 1/16" thick, inside surface of raised planters. Follow manufacturer's printed instructions for surface preparation, application and curing.

2.4 MORTAR AND GROUT MIXES:

A. Do not lower the freezing point of mortar by use of admixtures or antifreeze agents.

1. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with CBC 2103A.3 and CBC Table 21A-A for Type S mortar. Proportion Specification for types of mortar required, unless otherwise indicated.

C. Colored pigmented mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.

Mix to match adjacent mortar.

D. Grout for Unit Masonry: Comply with CBC 2103A.4 for grout for use in construction of reinforced and nonreinforced unit masonry, 2000 PSI @ 28 days minimum. Use grout of consistency indicated or if not otherwise indicated, of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout.

3. EXECUTION

3.1 PLACING REINFORCEMENT:

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials that will reduce bond to mortar or grout. Do not use reinforcement bar, kinks or bends not shown on drawings or final shop drawings or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing shown. 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", whichever is greater.

C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect and Structural Engineer. Provide lapped splices, unless otherwise shown. 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 governing code.

D. Weld splices where shown. Comply with the requirements of AWS D1.4 for welding materials and procedures.

E. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8" on exterior face of walls and ½" at other locations.

F. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.

1. At intersections of reinforced masonry walls with nonreinforced masonry, provide anchorage as shown.

3.2 INSTALLATION, GENERAL:

A. Thickness: Build masonry construction to the full thickness shown, except, build single width walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8" of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

C. Cut masonry units with mortar-driven saw designed to cut masonry with clean sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.

1. Do not wet concrete masonry units.

2. Match coursing, bonding, color and texture of new masonry work with existing work, where directed.

D. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs and wherever possible at other locations.

E. Lay-up walls plumb and with courses level, accurately spaced and coordinated with other work.

F. Stopping and Resuming Work: Rack back ½ masonry unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

G. Built-in work: As the work progresses, build-up items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar.

2. Where built-in items are to be imbedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

3. Fill CMU cores with grout courses (24") under bearing plates, beams, lintels, posts, and similar conditions unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING:

A. Lay hollow masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed including areas under cells. Prepare concrete to receive masonry by cleaning and sanding per CBC Section 1906 A.4.2.

B. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls, which are to be concealed or to be covered by other materials. Tool exposed joints slightly concave using a jointer larger than joint thickness. Rake out mortar in preparation for application.

C Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units, which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

Mix to match adjacent mortar.

D. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

E. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.

F. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.

G. Limit grout pours to sections that can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts that do not exceed 4'. Allow not less than 30 minutes or more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.

H. Low Lift Grouted Construction shall comply with CBC 2104A.6.1.2 and 2104A.6.1.2.2. Units shall be laid a maximum of 4 feet before grouting, and all overhanging mortar and mortar droppings shall be removed.

Grouting shall follow each 4 feet of construction laid and shall be consolidated so as to completely fill all voids and embed all reinforcing steel. When grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout not less than ½ inch nor more than 2 inches below the top of uppermost unit grouted. Horizontal steel shall be fully embedded in grout in an uninterrupted pour.

I. High-lift Grouted Construction: High-lift grouting is not permitted except when approved by the Office of Regulation Services, DSA, and by the Architect. When so approved, DSA Interpretive Regulation IR 21-2 shall be followed.

3.4 REPAIR, POINTING AND CLEANING:

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints enlarge any openings (except weep holes), and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean exposed masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendation in NCMA TEK Bulletin No.

3.5 TESTS AND INSPECTIONS:

Comply with CBC Section 1701A.5 and 2105A. Testing and Inspection shall be performed by an independent testing lab, contracted by the Owner, and approved by the Architect and ORS, DSA.

## END OF SECTION

# SECTION **05 12 00** - **STRUCTURAL STEEL FRAMING**

## 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. Structural steel.
2. Grout.

B. Related Sections:
1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
3. Section 05 50 00 "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.

### 1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

### 1.4 SUBMITTALS

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

B. California Green Building Standards Code Submittals:
1. Laboratory Test Reports: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name.

E. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welding connections. Include data on types of tests conducted and test results.

F. Qualification Data: For qualified Installer and fabricator**.**

G. Welding certificates indicating that welders employed in the work have satisfactorily passed AWS Qualification tests. If recertification of welders is required, retesting will be Contractor's responsibility.

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

I. Mill test reports for structural steel, including chemical and physical properties.

J. Product Test Reports: For the following:
1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

K. Source quality-control reports.

## 1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents, except as otherwise indicated:
1. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC 360 "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," latest edition, including "Commentary" and Supplements thereto as issued.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
4. AWS D1.1 "Structural Welding Code."
5. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

C. Preinstallation Conference: Conduct conference at Project site.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

D. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

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

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Metal Surfaces, General: For fabrication of 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. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. W-Shapes: ASTM A992.

C. Channels, Angles: ASTM A36.

D. Plate and Bar: ASTM A36.

E. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.

F. Steel Pipe: ASTM A53, Type E or S, Grade B.
   1. Finish: Black.

G. Steel Castings: ASTM A216, Grade WCB with supplementary requirement S11.

H. Steel Forgings: ASTM A668.

I. Welding Electrodes: Comply with AWS requirements and the following:
   1. All welding to be done using E70xx electrodes.
   2. For welding ASTM A572 grade 50 and ASTM A992 steel, maximum diffusible hydrogen content: 16ml/100g (H16).

3. Charpy V-Notch Toughness: 20 ft-lbs at 0°F (minimum.)

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Machine Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

B. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with mechanically deposited zinc coating.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

E. Shear Connectors: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Unheaded Anchor Rods: ASTM F1554, Grade 36.
   1. Configuration: Straight.
   2. Nuts: ASTM A563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A36 carbon steel.
   4. Washers: ASTM F436, Type 1, hardened carbon steel.
   5. Finish: Plain.

G. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
   1. Nuts: ASTM A563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A36 carbon steel.
   3. Washers: ASTM F436, Type 1, hardened carbon steel.
   4. Finish: Plain.

H. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A563 heavy-hex carbon steel.
   2. Washers: ASTM A36 carbon steel.
   3. Finish: Plain.

I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A108, Grade 1035.

J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1030.

K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1018.

## 2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

## 2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. Minimum Compressive Strength: 7500 psi at 28 days.

## 2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
   6. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/ and manufacturer's written instructions.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened and Slip critical. Refer to structural drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."

C. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 2.0 mils.

## 2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

D. Welded Connections: If required, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E165.
   2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E164.
   4. Radiographic Inspection: ASTM E94.

E. If required, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect.

B. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

### 3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Anchor Bolts: Furnish Anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
   1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
   2. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete.

C. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on setting (leveling) nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Mai**nt**ain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

F. Splice members only where indicated.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

## 3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened and Slip critical.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
   3. On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
   4. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

## 3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. If required, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E165.
      b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E164.
      d. Radiographic Inspection: ASTM E94.

D. If required, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

**END OF SECTION 05 12 00**

# SECTION **05 12 00** - **STRUCTURAL STEEL FRAMING**

## 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. Structural steel.
2. Grout.

B. Related Sections:
1. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
2. Section 05 50 00 "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.

### 1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

### 1.4 SUBMITTALS

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

B. California Green Building Standards Code Submittals:
1. Laboratory Test Reports: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name.

E. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welding connections. Include data on types of tests conducted and test results.

F. Qualification Data: For qualified Installer and fabricator**.**

G. Welding certificates indicating that welders employed in the work have satisfactorily passed AWS Qualification tests. If recertification of welders is required, retesting will be Contractor's responsibility.

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

I. Mill test reports for structural steel, including chemical and physical properties.

J. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength bolt-nut-washer assemblies.
   4. Shear stud connectors.
   5. Shop primers.
   6. Non-shrink grout.

K. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents, except as otherwise indicated:
   1. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."
   2. AISC 360 "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," latest edition, including "Commentary" and Supplements thereto as issued.
   3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   4. AWS D1.1 "Structural Welding Code."
   5. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

C. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

D. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

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

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Metal Surfaces, General: For fabrication of 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. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. W-Shapes: ASTM A992.

C. Channels, Angles: ASTM A36.

D. Plate and Bar: ASTM A36.

E. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.

F. Steel Pipe: ASTM A53, Type E or S, Grade B.
1. Finish: Black.

G. Steel Castings: ASTM A216, Grade WCB with supplementary requirement S11.

H. Steel Forgings: ASTM A668.

I. Welding Electrodes: Comply with AWS requirements and the following:
1. All welding to be done using E70xx electrodes.
2. For welding ASTM A572 grade 50 and ASTM A992 steel, maximum diffusible hydrogen content: 16ml/100g (H16).
3. Charpy V-Notch Toughness: 20 ft-lbs at 0°F (minimum.)

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Machine Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

B. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip or mechanically deposited zinc coating.
   2. Direct-Tension Indicators: ASTM F959, Type 325, compressible-washer type with mechanically deposited zinc coating.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

E. Shear Connectors: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Unheaded Anchor Rods: ASTM F1554, Grade 36.
   1. Configuration: Straight.
   2. Nuts: ASTM A563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A36 carbon steel.
   4. Washers: ASTM F436, Type 1, hardened carbon steel.
   5. Finish: Plain.

G. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
   1. Nuts: ASTM A563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A36 carbon steel.
   3. Washers: ASTM F436, Type 1, hardened carbon steel.
   4. Finish: Plain.

H. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A563 heavy-hex carbon steel.
   2. Washers: ASTM A36 carbon steel.
   3. Finish: Plain.

I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A108, Grade 1035.

J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1030.

K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade 1018.

## 2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

## 2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. Minimum Compressive Strength: 7500 psi at 28 days.

## 2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A6 and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
   6. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/ and manufacturer's written instructions.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened and Slip critical. Refer to structural drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."

C. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 2.0 mils.

## 2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

D. Welded Connections: If required, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E165.
   2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E164.
   4. Radiographic Inspection: ASTM E94.

E. If required, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect.

B. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

### 3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Anchor Bolts: Furnish Anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
   1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
   2. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete.

C. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on setting (leveling) nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.

2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

F. Splice members only where indicated.

G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

## 3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened and Slip critical.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
   3. On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
   4. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

## 3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. If required, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E165.
      b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E164.
      d. Radiographic Inspection: ASTM E94.

D. If required, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

**END OF SECTION 05 12 00**

# SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

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 architecturally exposed structural-steel (AESS).

1. Requirements in Section 05 12 00 "Structural Steel Framing" also apply to AESS.

1.3 DEFINITIONS

A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents.

1.4 COORDINATION

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

1.5 SUBMITTALS

A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation of bolt heads.
5. Indicate exposed surfaces and edges and surface preparation being used.
6. Indicate special tolerances and erection requirements.

B. Samples: Submit Samples of AESS to set quality standards for exposed welds .

1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.

C. Qualification Data: For Installer and fabricator.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 FILLER

A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.2 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
2. Grind sheared, punched, and flame-cut edges of Category 1 AESS to remove burrs and provide smooth surfaces and edges.
3. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
4. Fabricate Category 1 and Category 2 AESS with exposed surfaces free of seams to maximum extent possible.
5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.

7. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
8. Fabricate Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 1 AESS.

C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.

1. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet under any lighting conditions.
2. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch.

D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for Category 1 AESS.

E. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.3 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened and Slip critical. Refer to structural drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where Category 1 AESS is exposed to weather.
4. Provide continuous welds of uniform size and profile where Category 1 AESS is welded.
5. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch for Category 1 and Category 2 AESS.
6. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch for Category 1 and Category 2 AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
7. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.

8. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
9. Make fillet welds for Category 1 and Category 2 AESS oversize and grind to uniform profile with smooth face and transition.
10. Make fillet welds for Category 1 and Category 2 AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.4 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
2. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

1. Erect Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
2. Erect Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

B. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened and Slip critical.
2. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.

B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.

1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
2. Remove erection bolts in AESS, fill holes, and grind smooth.
3. Fill weld access holes in AESS and grind smooth.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 05 12 00 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

**END OF SECTION 05 12 13**

# SECTION 05 30 00 – METAL ROOF DECK

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Work included: Provide metal roof deck and accessories as shown on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related work specified elsewhere

1. Section 05 12 00 – Structural Steel
2. Section 05 40 00 – Cold-Formed Metal Framing (Structural)

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 SUBMITTALS

A. Product Data: Within 21 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

3. Shop Drawings showing layout of decking, with details of materials, gages, accessories, openings, finishes, welds, and other pertinent conditions;

4. Manufacturer's recommended installation procedures which when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.5 PRODUCT HANDLING

A. Delivery and storage:

1. Deliver materials to the job site properly marked to identify the location for which they are intended.

2. Use markings corresponding to markings shown on the approved Shop Drawings.

3. Store in a manner to maintain identification and prevent damage, off the ground, using pallets or other supports, and to permit easy access for inspection.

2. METAL ROOF DECK UNITS

A. Properties:

1. Form from galvanized steel sheets complying with ASTM A446 or ASTM A653, with a minimum yield strength of 38,000 psi, and coat in accordance with ASTM A525, Designation G60.

2. Provide the deck profile type and gauge shown on the Drawings.

2.1 ACCESSORIES

A. Provide accessories specifically designed to be used with the metal deck units supplied to the Work, and as normal to the uses shown on the Drawings including, but not necessarily limited to, ridge and valley plates, closures, cant strips, and sump pans if required.

B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

3. EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until satisfactory conditions are corrected.

3.2 INSTALLATION

A. Prior to start of installation, verify that beams are in proper alignment and that surfaces are clear for fastening.

B. Place each unit on the supporting steel framework, and adjust to final position prior to permanent fastening.

1. Fasten panels to each structural support by powder actuated fasteners as indicated on the drawings.

2. Fasten sheet metal accessories by tack welding or screwing at 3’-0” on center, unless indicated otherwise.

3. Weld sump pans, when required, directly to the deck at 6” on center around the perimeter of the pan.

4. Button-punch panels together if so indicated on the Drawings, recommended by the manufacturer, or required by governmental agencies having jurisdiction.

C. Complete installation in accordance with the manufacturer’s recommendations as approved by the Architect.

3.3 TOUCH-UP

A. Upon completion of the installation, and as a condition of its acceptance, visually inspect each item installed under this Section and locate surfaces where finish was damaged.

1. Touch-up galvanized surfaces with zinc-rich primer or other galvanized repair paint approved for the purpose by the Architect.

2. Touch-up other damaged surfaces as required to return the surfaces to conditions commensurate with the services required.

**END OF SECTION**

# SECTION **05 31 00** - **STEEL DECKING**

## 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 deck.
   2. Composite floor deck.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for normal-weight structural concrete fill over steel deck.
   2. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
   3. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

### 1.3 SUBMITTALS

A. Product Data and Manufacturer's Specifications: For each type of deck, accessory, and product indicated.

B. Manufacturer's recommended installation procedures which when approved by Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

C. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

D. Welding certificates.

E. Product Certificates: For each type of steel deck.

F. Evaluation Reports: For steel deck and power-actuated mechanical fasteners.

### 1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
   2. Steel deck manufacturer shall supply deck free of lubricants or oils which would impair the adhesion of spray applied fireproofing.
   3. The deck manufacturer shall certify that the steel deck has been fire tested with the appropriate fireproofing material.

2.2 ROOF DECK

A. Basis-of-Design Product: Subject to compliance with requirements, provide Verco Manufacturing Co.; PLB-36 (IAPMO ER-0217) or comparable product by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company; DBG-36 & DBGF-36 (ICC ESR-1414).

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653 (Fy= 40 ksi), Structural Steel (SS), Grade 40 (minimum), G90 zinc coating.
   2. Deck Profile: As indicated on approved drawings.
   3. Profile Depth: 1-1/2 inches.
   4. Design Uncoated-Steel Thickness: As indicated on approved drawings.
   5. Span Condition: As indicated on approved drawings.
   6. Side Laps: Interlocking seam.

2.3 COMPOSITE FLOOR DECK

A. Basis-of-Design Product: Subject to compliance with requirements, provide Verco Manufacturing Co.; W3 FORMLOK (IAPMO ER-0217) or comparable product by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company; 3W Hi Form (ICC ESR-2408)

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: ASTM A653 (Fy= 40 ksi), Structural Steel (SS), Grade 40, G60 zinc coating.
   2. Profile Depth: 3 inches.
   3. Design Uncoated-Steel Thickness: As Indicated on approved drawings.
   4. Span Condition: As indicated on approved drawings.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated as submitted to and approved by Architect.

B. Powder Actuated Fasteners (Shot Pins): Hilti, Inc., Powder Actuated Fasteners per ICC ESR-2197 or an approved equal with current ICC ES Report tested per ICC ES AC 43 as shown and called for on the approved drawings.

C. Side-Lap Fasteners: Verco Punchlok or ASC DeltaGrip as shown and called for on the approved drawings.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber (neoprene).

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

H. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section as submitted to and approved by Architect.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

## 3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members with mechanical fasteners as shown on the approved drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as shown on the approved drawings with the steel deck manufacturer’s required tool.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Butted.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 6 inches apart around the perimeter of the pan with at least one weld at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten as shown on drawings.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions as submitted to and approved by Architect and as detailed on the drawings. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips where indicated on drawings. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

## 3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 1 inch, nominal.
   2. Weld Spacing: Space and locate welds as indicated on the approved drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as shown on the approved drawings with the steel deck manufacturer's required tool.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Flexible Closure Strips: Install flexible closure strips where indicated on drawings. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.5 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Architect, DSA, and Contractor.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions as submitted to and approved by Architect.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

**END OF SECTION 05 31 00**

# SECTION **05 31 00** - **STEEL DECKING**

## 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 deck.

B. Related Requirements:
   1. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
   2. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

### 1.3 SUBMITTALS

A. Product Data and Manufacturer's Specifications: For each type of deck, accessory, and product indicated.

B. Manufacturer's recommended installation procedures which when approved by Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

C. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

D. Welding certificates.

E. Product Certificates: For each type of steel deck.

F. Evaluation Reports: For steel deck and power-actuated mechanical fasteners.

### 1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
   2. Steel deck manufacturer shall supply deck free of lubricants or oils which would impair the adhesion of spray applied fireproofing.
   3. The deck manufacturer shall certify that the steel deck has been fire tested with the appropriate fireproofing material.

2.2 ROOF DECK

A. Basis-of-Design Product: Subject to compliance with requirements, provide Verco Manufacturing Co.; PLB-36 (IAPMO ER-0217) or comparable product by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company; DBG-36 & DBGF-36 (ICC ESR-1414).

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653 (Fy= 40 ksi), Structural Steel (SS), Grade 40 (minimum), G90 zinc coating.
   2. Deck Profile: As indicated on approved drawings.
   3. Profile Depth: 1-1/2 inches.
   4. Design Uncoated-Steel Thickness: As indicated on approved drawings.
   5. Span Condition: As indicated on approved drawings.
   6. Side Laps: Interlocking seam.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated as submitted to and approved by Architect.

B. Powder Actuated Fasteners (Shot Pins): Hilti, Inc., Powder Actuated Fasteners per ICC ESR-2197 or an approved equal with current ICC ES Report tested per ICC ES AC 43 as shown and called for on the approved drawings.

C. Side-Lap Fasteners: Verco Punchlok or ASC DeltaGrip as shown and called for on the approved drawings.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber (neoprene).

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

G. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

### 3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section as submitted to and approved by Architect.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

## 3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members with mechanical fasteners as shown on the approved drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as shown on the approved drawings with the steel deck manufacturer's required tool.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Butted.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions as submitted to and approved by Architect and as detailed on the drawings. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

E. **Flexible Closure Strips**: Install flexible closure strips over **partitions, walls, and where indicated on drawings**. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

## 3.4 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Architect, DSA, and Contractor.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

## 3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions as submitted to and approved by Architect.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

**END OF SECTION 05 31 00**

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

## 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. Load-bearing wall framing.
2. Non-load-bearing wall framing.
3. Ceiling joist framing.
4. Soffit framing.

B. Related Requirements:
1. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall and fire rated ceiling assemblies.

### 1.3 SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Welding certificates.

C. Research Reports: For cold-formed steel framing, from ICC-ES.

### 1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

## PART 2 - PRODUCTS

### 2.1 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: ST33H and ST50H as called for on drawings.
2. Coating: G60.

2.2 WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on approved drawings.
   2. Flange Width: 1-5/8 inches, minimum.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated on approved drawings, unpunched, with straight flanges, and as follows:
   1. Base-Metal Thickness: Matching steel studs, minimum.
   2. Flange Width: 1-1/4 inches, minimum.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on approved drawings.
   2. Flange Width: 1-3/8 inches, minimum.

D. Slip Deflection Track (where shown on approved drawings): Manufacturer's single, deep-leg, U-shaped steel track; with horizontal slotted web and vertical slotted flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to be fastened to the studs, support horizontal loads, and transfer them to the primary structure, and as follows:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Brady Construction Innovations Inc.; SLP-TRK (ICC ESR-1042) or an approved equal with current ICC-ES evaluation report or other acceptable evaluation reports or testing acceptable to DSA.
      a. Minimum Base-Metal Thickness: Matching steel studs as shown on approved drawings. (16 gauge minimum at exterior walls)
      b. Flange Width: 2-1/2 inches
      c. Flange Slots: 1/4 inch wide by 1 1/2 inches long spaced every 1 inch along length of track.
      d. Web Slots: Two 3/16 inch wide by 2 1/4 inches long spaced 8 inches o.c., staggered.

E. Double Deflection Tracks (where shown on approved drawings): Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: Matching steel studs as shown on approved drawings, minimum. (16 gauge minimum at exterior walls).
      b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications. Refer to approved drawings for design gap.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: Matching steel studs as shown on approved drawings, minimum. (16 gauge minimum at exterior walls).
      b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

2.3 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated on approved drawings, punched with standard holes, with stiffened flanges, and as follows:

1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on approved drawings.
2. Flange Width: 1-5/8 inches , minimum.

2.4 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on drawings.
2. Flange Width: 1-5/8 inches, minimum.
3. Section Properties: Refer to drawings.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003, Structural Grade, Type H, metallic coated, of same grade and coating weight 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 (unpunched).
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, headless, hooked bolts or headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers. The anchor bolt assembly shall be zinc coated by hot-dip process according to ASTM A 153, Class C or mechanically deposition according to ASTM B 695, Class 50.

C. Expansion Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to 2013 CBC, section 1908A or 1909A; ICC-ES AC193 and ACI 318-08 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

E. 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.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates 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 to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets 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. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions as submitted to and approved by Architect unless more stringent requirements are indicated on drawings.

B. 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 or screw fastening. Wire tying of framing members is not permitted except where specifically detailed on drawings.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to drawings, and complying with requirements for spacing, edge distances, and screw penetration.

C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity 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.

E. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

F. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

H. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: As shown on approved drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
   1. Stud Spacing: 16 inches maximum unless otherwise indicated on approved drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads as detailed on drawings.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates as detailed on approved drawings.
   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on drawings. Fasten jamb members together to uniformly distribute loads.
   2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in stud system, spaced vertically as indicated on approved drawings. Fasten at each stud intersection.
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
   2. Bridging (**Plumbing Walls and walls greater than 8" deep**): Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging (**Solid Blocking**): Where shown on the drawings install stud or stud track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

I. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches maximum unless otherwise indicated.

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. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to bypassing studs and anchor to building structure as detailed on the approved drawings.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on approved drawings but not more than 48 inches apart. Fasten at each stud intersection. **For interior non-load bearing walls, bridging is not required when sheathing is installed on both sides of the wall.**
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Bridging (**Plumbing walls**): Combination of flat, taut, steel sheet straps of width and thickness indicated on drawings and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging (**Solid Blocking**): Where shown on the drawings install stud or stud track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

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.

3.6 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:
   1. Joist Spacing: As indicated on the drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track as detailed on drawings.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on drawings.
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on approved drawings. Fasten bridging at each joist intersection as follows:
   1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to DSA, Contractor, Owner, Structural Engineer, and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. 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 40 00** - **COLD-FORMED METAL FRAMING**

## 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. Load-bearing wall framing.
2. Non-load-bearing wall framing.
3. Ceiling joist framing.
4. Soffit framing.

B. Related Requirements:

### 1.3 SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Welding certificates.

C. Research Reports: For cold-formed steel framing, from ICC-ES.

### 1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

## PART 2 - PRODUCTS

### 2.1 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: ST33H and ST50H as called for on drawings.
2. Coating: G60.

### 2.2 WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on approved drawings.
2. Flange Width: 1-5/8 inches, minimum.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated on approved drawings, unpunched, with straight flanges, and as follows:
1. Base-Metal Thickness: Matching steel studs, minimum.
2. Flange Width: 1-1/4 inches, minimum.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on approved drawings.
2. Flange Width: 1-3/8 inches, minimum.

D. Slip Deflection Track (where shown on approved drawings): Manufacturer's single, deep-leg, U-shaped steel track; with horizontal slotted web and vertical slotted flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to be fastened to the studs, support horizontal loads, and transfer them to the primary structure, and as follows:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Brady Construction Innovations Inc.; SLP-TRK (ICC ESR-1042) or an approved equal with current ICC-ES evaluation report or other acceptable evaluation reports or testing acceptable to DSA.
   a. Minimum Base-Metal Thickness: Matching steel studs as shown on approved drawings. (16 gauge minimum at exterior walls)
   b. Flange Width: 2-1/2 inches
   c. Flange Slots: 1/4 inch wide by 1 1/2 inches long spaced every 1 inch along length of track.
   d. Web Slots: Two 3/16 inch wide by 2 1/4 inches long spaced 8 inches o.c., staggered.

E. Double Deflection Tracks (where shown on approved drawings): Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   a. Minimum Base-Metal Thickness: Matching steel studs as shown on approved drawings, minimum. (16 gauge minimum at exterior walls).
   b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications. Refer to approved drawings for design gap.
2. Inner Track: Of web depth indicated, and as follows:
   a. Minimum Base-Metal Thickness: Matching steel studs as shown on approved drawings, minimum. (16 gauge minimum at exterior walls).
   b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

2.3 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated on approved drawings, punched with standard holes, with stiffened flanges, and as follows:
1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on approved drawings.
2. Flange Width: 1-3/8 inches , minimum.

2.4 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Base-Metal Thickness: 0.0428 inch (18 gauge) to 0.0966 inch (12 gauge) as shown on drawings.
   2. Flange Width: 1-3/8 inches, minimum.
   3. Section Properties: Refer to drawings.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003, Structural Grade, Type H, metallic coated, of same grade and coating weight 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 (unpunched).
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers and knee braces.
   9. Joist hangers and end closures.
   10. Hole reinforcing plates.
   11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, headless, hooked bolts or headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers. The anchor bolt assembly shall be zinc coated by hot-dip process according to ASTM A 153, Class C or mechanically deposition according to ASTM B 695, Class 50.

C. Expansion Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to 2016 CBC, section 1908A or 1909A; ICC-ES AC193 and ACI 318-08 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

E. 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.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates 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 to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets 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. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions as submitted to and approved by Architect unless more stringent requirements are indicated on drawings.

B. 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 or screw fastening. Wire tying of framing members is not permitted except where specifically detailed on drawings.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to drawings, and complying with requirements for spacing, edge distances, and screw penetration.

C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity 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.

E. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

F. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

H. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: As shown on approved drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
   1. Stud Spacing: 16 inches maximum unless otherwise indicated on approved drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads as detailed on drawings.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates as detailed on approved drawings.
   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on drawings. Fasten jamb members together to uniformly distribute loads.
   2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in stud system, spaced vertically as indicated on approved drawings. Fasten at each stud intersection.
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
   2. Bridging (**Plumbing Walls and walls greater than 8" deep**): Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging (**Solid Blocking**): Where shown on the drawings install stud or stud track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

I. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches maximum unless otherwise indicated.

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. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to bypassing studs and anchor to building structure as detailed on the approved drawings.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on approved drawings but not more than 48 inches apart. Fasten at each stud intersection. **For non-load bearing walls, bridging is not required when sheathing is installed on both sides of the wall.**
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Bridging (**Plumbing walls**): Combination of flat, taut, steel sheet straps of width and thickness indicated on drawings and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging (**Solid Blocking**): Where shown on the drawings install stud or stud track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

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.

3.6 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:
   1. Joist Spacing: As indicated on the drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track as detailed on drawings.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on drawings.
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on approved drawings. Fasten bridging at each joist intersection as follows:
   1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to DSA, Contractor, Owner, Structural Engineer, and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. 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 FABRICATIONS**

## 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. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Steel shapes for supporting elevator door sills.
5. Metal ladders.
6. Metal floor plate.
7. Miscellaneous steel trim.
8. Metal bollards.
9. Abrasive metal nosings.
10. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:
1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:
1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 05 12 00 "Structural Steel Framing."
3. Section 05 51 00 "Metal Stairs."
4. Section 05 52 13 "Pipe and Tube Railings."
5. Section 12 93 00 "Site Furnishings" for bicycle racks.

### 1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### 1.4 SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.

2. Metal nosings and treads.
3. Paint products.
4. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

D. Welding certificates.

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

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.2, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

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

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

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

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36.

B. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.

C. Steel Tubing: ASTM A500, cold-formed steel tubing.

D. Steel Pipe: ASTM A53, standard weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated.
   2. Material: Cold-rolled steel, ASTM A1008/, structural steel, Grade 33; 0.0966-inch (12 gauge) minimum thickness; unfinished.

F. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B632, Alloy 6061-T6.

D. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Eyebolts: ASTM A489.

G. Machine Screws: ASME B18.6.3.

H. Lag Screws: ASME B18.2.1.

I. Wood Screws: Flat head, ASME B18.6.1.

J. Plain Washers: Round, ASME B18.22.1.

K. Lock Washers: Helical, spring type, ASME B18.21.1.

L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

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

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

E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

## 2.6 FABRICATION, GENERAL

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

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

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

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

E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

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

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

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

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.8 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 and Cal-OSHA unless otherwise indicated.

B. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. O'Keeffe's Inc.
   b. ACL Industries, Inc.
   c. Alco-Lite Industrial Products.
   d. Halliday Products.
   e. Precision Ladders, LLC.
   f. Royalite Manufacturing, Inc.
   g. Thompson Fabricating, LLC.
2. Space siderails 16 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
6. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating or extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 3/4 inch in least dimension.
7. Support each ladder with welded or bolted aluminum brackets.

## 2.9 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:
   1. Thickness: As indicated.

## 2.10 MISCELLANEOUS STEEL TRIM

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

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime interior miscellaneous steel trim with zinc-rich primer.

## 2.11 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.
   1. Cap bollards where indicated on drawings.
   2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
   3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
   4. Where removable bollards are indicated, fabricate hardware to facilitate locking bollard in place as indicated on drawings.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 36 inches deep and 3/4 inch larger than OD of bollard.

C. Galvanize bollards.

2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

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

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

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported as indicated on drawings and including manufacturers' written instructions and requirements indicated on Shop Drawings as submitted to and approved by Architect.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure as detailed on drawings.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Anchor pipe sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation or provide machine thru bolt stop as detailed on drawings. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

C. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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

**END OF SECTION 05 50 00**

# SECTION **05 50 00** - **METAL FABRICATIONS**

## 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. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal ladders.
5. Metal floor plate.
6. Miscellaneous steel trim.
7. Metal bollards.
8. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:
1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:
1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 05 12 00 "Structural Steel Framing."
3. Section 12 93 00 "Site Furnishings" for bicycle racks.

### 1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### 1.4 SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

D. Welding certificates.

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

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.2, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

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

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

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

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36.

B. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.

C. Steel Tubing: ASTM A500, cold-formed steel tubing.

D. Steel Pipe: ASTM A53, standard weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated.
   2. Material: Cold-rolled steel, ASTM A1008/, structural steel, Grade 33; 0.0966-inch (12 gauge) minimum thickness; unfinished.

F. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B632, Alloy 6061-T6.

D. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless-steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Eyebolts: ASTM A489.

G. Machine Screws: ASME B18.6.3.

H. Lag Screws: ASME B18.2.1.

I. Wood Screws: Flat head, ASME B18.6.1.

J. Plain Washers: Round, ASME B18.22.1.

K. Lock Washers: Helical, spring type, ASME B18.21.1.

L. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

M. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

## 2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

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

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

E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

## 2.6 FABRICATION, GENERAL

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

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

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

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

E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

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

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

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

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.8 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 and Cal-OSHA unless otherwise indicated.

B. Aluminum Ladders: Tubular Rail Low Parapet Access Ladder with Walk-through Rail Extension
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. O'Keeffe's Inc.; Model 504
      b. ACL Industries, Inc.
      c. Alco-Lite Industrial Products.

d. Halliday Products.
e. Precision Ladders, LLC.
f. Royalite Manufacturing, Inc.
g. Thompson Fabricating, LLC.

2. Space siderails 24 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
6. Provide Walk-through Rail Extensions fabricated from same materials as Siderails.
7. Support each ladder with welded or bolted aluminum brackets.

## 2.9 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:
1. Thickness: As indicated.

## 2.10 MISCELLANEOUS STEEL TRIM

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

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime interior miscellaneous steel trim with zinc-rich primer.

## 2.11 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.
1. Cap bollards where indicated on drawings.
2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
4. Where removable bollards are indicated, fabricate hardware to facilitate locking bollard in place as indicated on drawings.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 36 inches deep and 3/4 inch larger than OD of bollard.

C. Galvanize bollards.

2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.16 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

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

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

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported as indicated on drawings and including manufacturers' written instructions and requirements indicated on Shop Drawings as submitted to and approved by Architect.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure as detailed on drawings.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Anchor pipe sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation or provide machine thru bolt stop as detailed on drawings. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

C. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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

**END OF SECTION 05 50 00**

## SECTION 05 50 ~~00~~01 – MISCELLANEOUS METALS

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Extent: Extent of metal fabrication is indicted on drawings and schedules.

C. Types: Work in this section include metal fabrications for:

1. Rough hardware
2. Ladders
3. Nosings
4. Loose bearing and leveling plates
5. Loose steel lintels
6. Miscellaneous framing and supports
7. Miscellaneous steel trim
8. Steel pipe railings
9. Louvered roof-top sun screens
10. Architectural Louvers

D. Structural steel is specified in another section within Division 5.

1.3 SYSTEM PERFORMANCES:

A. Structural Performances: Provide assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

1. Handrails and Toprails: Capable of withstanding the following loads applied as indicated when tested per ASTM E 935.

a. Concentrated loads of 200 lbs. applied at any point in any direction.

b. Uniform load of 50 lbs. per linear ft. applied simultaneously in both vertical and horizontal directions.

c. Concentrated and uniform loads above need not be assumed to act concurrently.

1.4 QUALITY ASSURANCE:

A. Shop Assembly: Pre-assemble 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 coordination installation.

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1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

C. Samples: Submit two sets of representative samples of materials and finished products as may be requested by Architect.

2. PRODUCTS

2.1 MATERIALS

A. Ferrous Metals:

1. 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.

2. Steel Plates, Shapes and Bars: ASTM A 36

3. Steel Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 501.

4. Structural Steel Sheet: hot rolled, ASTM A 570, or cold-rolled ASTM A 611, Class 1; of grade required for design loading.

5. Galvanized Structural Steel Sheet: ASTM A 446, of grade required for design loading. Coating designation as indicated, or if not indicated, G90.

6. Non-Structural Steel Pipe: ASTM A 53; type and grade (if applicable) as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.

7. Gray Iron Castings ASTM A48, Class 30.

8. Malleable Iron Castings ASTM A 47, grade as selected by fabricator.

9. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

10. 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 A 153. See Structural Drawings.

B. Grout

1. Metallic Non-Shrink Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with CE CRD-C621. Provide grout

2. Specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

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C. Fasteners:

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

3. Lag Bolts: Square head type, FS FF-B-561.

4. Machine Screws: Cadmium plated steel, FS FF-S-92.

5. Wood Screws: Flat head carbon steel, FS FF-S-111.

6. Plain Washers: Round, carbon steel, FS FF-S-92.

7. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

8. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

D. Paint:

1. Shop Primer for Ferrous Metal: Fast curing, lead free, abrasion-resistant, rust-Inhibitive primer selected for compatibility with substrates and with types of acrylic-type finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements only of FS TT P 86, Types I, II and III.

2. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, complying with the Military Specifications MIL- P -21035 (Ships) or SSPC Paint-20.

E. Concrete Fill:

1. Concrete materials and Properties: Comply with requirements of Division 3, Section, "Concrete Work: for normal weight, ready-mix concrete with minimum 28-day compressive strength of 3000 psi, unless higher strengths indicated.

2. Non-Slip Aggregate Finish: Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rust-proof and non-glazing; unaffected by freezing, moisture or cleaning materials.

2.2 FABRICATION, GENERAL:

A. Workmanship: Unless materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

B. 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" unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

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C. 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.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat head (countersunk) screws or bolts.

E. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.

3. ASTM A 386 for galvanizing assembled steel products.

H. Fabricate joints, which will be exposed to weather, in a manner to exclude water or provide weep holes where water may accumulate.

I. Shop Painting:

1. Apply shop primer to surfaces of metal fabrications except those which are galvanized or as indicated to be embedded in concrete or masonry, unless otherwise indicated, and in compliance with requirements of SSPC –PAL "Paint Application Specification No. 1" for shop painting.

2.3 ROUGH HARDWARE:

A. 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 for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6, sections.

B. 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.

2.4 LADDERS

A. Fabricate ladders for the locations shown, with dimensions, spacing, details and anchorages as indicted. Comply with requirements of ANSI A14.3, unless otherwise indicated.

Unless otherwise indicated, provide 3/8" x 2 ½" continuous structural steel flat bar side rails with eased edges, spaced 18" apart.

Provide ¾" diameter solid structural steel bar rungs, spaced 12" o.c.

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B. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rails faces.

C. Support each ladder at top and bottom and at intermediate points spaced not more than 4' 0" o.c. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold ladder clear of the wall surface with a minimum of 7"clearance from wall to centerline of rungs. Extend rails 42"above top rung and return rails to wall or structure unless sother secure handholds are provided. If the adjacent structure does not extend above the top rung, gooseneck the extended rail back to the structure to provide secure ladder access.

D. Provide non-slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout.

2.5 NOSINGS:

A. Provide curb nosings fabricated of structural steel shapes as indicted, of all welded construction with mitered corners and continuously welded joints. Provide anchors welded to nosings for embedding in concrete or masonry construction, spaced not more than 6" from each curb end, 6" from corners and 24" o.c., unless otherwise indicated.

1. Galvanize exterior nosings, and where indicated.

2.6 LOOSE BEARING AND LEVELING PLATES:

A. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings, unless otherwise indicated.

B. Galvanize loose steel lintels to be installed in exterior walls.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS:

A. Provide miscellaneous steel framing and supports, which are not a part of structural steel framework, as required to complete work.

B. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicted, fabricate from structural steel shapes, plates and steel bars of welded construction using metered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

C. Equip units with integrally welded anchors for casting into concrete or building masonry. Furnish inserts if units must be installed after concrete is placed.

1. Except as otherwise indicted, space anchors 24" o.c. and provide minimum anchor units of 1 ¼" x ¼" x 8" steel straps.

D. Galvanize miscellaneous frames and supports where indicated.

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2.9 MISCELLANEOUS STEEL TRIM:

A. Provide shapes and sizes indicted for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed filed splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

B. Galvanize miscellaneous steel trim where indicated.

2.10 STEEL PIPE RAILINGS AND HANDRAILS:

A. Fabricate steel pipe railings and handrails to design, dimensions, and details indicted. Provide railings and handrails members formed of pipe and of sizes and wall thickness indicated, but not less than that required to support design loading.

B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

C. At tee and cross intersections provide coped joints.

D. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable, of radiuses indicated.

E. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.

F. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.

G. Toe Boards: Where indicated, provide toeboards at railings around openings and at the edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, use a 4" high x 1/8" plate welded to, center between, each railing post.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnection of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.

2.11 ARCHITECTURAL LOUVERS

A. Manufacturer: GREENHECK
Schofield, WI
(715) 359-6171

B. Product: Rain Resistant Louver "EHH-401"

C. Material: Heavy gauge 6063T5 extruded aluminum, 4" deep, 0.081 in. thick.

D. Louver: 6063T5 extruded aluminum, 0.081 in. thick, 2" spacing.

E. Features: Horizontal rain resistant style, fitted with bird screens. Provide "Fluropon" (70% Kynar 500/Hylar 5000) finish with color as selected by architect from manufacturer's standard range. See plans for size and configuration.

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3. EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, 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. GENERAL:

1. Fastening to In-Place Construction: provide anchorage devices and fasteners where necessary securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

2. Cutting, Fitting, and Placement: Perform cutting, drilling and fitting required for Installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plus, 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.

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

4. 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.

5. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

6. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of bearing plate before packing with grout. Pack grout under plate before applying full dead load.

B. STEEL PIPE RAILINGS AND HANDRAILS

1. Adjust railing prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicted, as required by design loadings.

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Plumb posts in each direction. Secure posts and railing ends to building construction as follows:

a. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.

b. Anchor rail ends in concrete and masonry with steel oval or round flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.

2. Secure handrails to wall brackets and end fittings. Provide bracket with not less than 1 ½" clearance from inside face of handrail and finished wall surface. Locate brackets as indicated, or if not indicated, at spacing required for design loading. Secure wall brackets and wall return fittings to building construction as follows:

a. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

b. For stud partitions use self-tapping sheet metal screws set into metal backing between studs. Coordinate with stud installations for accurate location of backing members.

3.3 ADJUST AND CLEAN:

A. 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.

B. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

**END OF SECTION**

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# SECTION **05 51 13** - **METAL PAN STAIRS**

## 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. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 05 40 00 "Cold-Formed Metal Framing" for metal backing for anchoring railings.

### 1.3 COORDINATION

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

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

D. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

### 1.4 SUBMITTALS

A. Product Data: For metal pan stairs and the following:
1. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Welding certificates.

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

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbs/sq. ft..
   2. Concentrated Load: 300 lbs. applied on an area of 2 inches by 2 inches.
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

B. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lb/ft. applied in any direction along the handrail or top rail.
      b. Concentrated load of 200 lb applied in any direction at any point.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lb applied horizontally on an area not to exceed 12 inches by 12 inches.
      b. Infill load and other loads need not be assumed to act concurrently.

C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Component Importance Factor: 1.5.

2.2 METALS

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

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

C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A513.

D. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

D. Expansion Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to 2013 CBC, section 1908A or 1909A; ICC-ES AC193 and ACI 318-11, greater than or equal to the design load, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
   1. Minimum Compressive Strength: 7500 psi at 28 days.

E. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

F. Welded Wire Reinforcement: ASTM A185/A185M, 6 by 6 inches, W2.9 by W2.9, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
   1. Join components by welding unless otherwise indicated.
   2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

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

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

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

F. Weld connections to comply 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. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.6 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:
1. Fabricate stringers of steel channels and tubes as shown on the approved drawings..
2. Construct platforms of steel tube headers and miscellaneous framing members as indicated.
3. Weld stringers to headers; weld framing members to stringers and headers
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness indicated.
1. Steel Sheet: Uncoated hot-rolled steel sheet unless otherwise indicated.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration indicated.

2.7 STAIR RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:
1. By bending or by inserting prefabricated elbow fittings.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
   1. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
   2. Provide type of bracket indicated on the approved drawings and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

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

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
   1. Anchor posts to steel by welding to steel supporting members.
   2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets. Locate brackets as indicated. Secure wall brackets to building construction as follows:
   1. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.3 ADJUSTING AND CLEANING

A. Touchup 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 to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 51 13

# SECTION **05 52 13** - **PIPE AND TUBE RAILINGS**

## 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. Steel pipe and tube railings.

### 1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guardrails:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guardrails (intermediate rails (all those except handrail), balusters, and panel fillers):
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

### 1.4 SUBMITTALS

A. Product Data: For the following:
   1. Grout, anchoring cement, and paint products.
   2. Mill certificates for Steel Pipe or Tubing.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Welding certificates.

### 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.2 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are indicated.
   1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

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

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.4 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

B. Assemble railings in the 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. Use connections that maintain structural value of joined pieces.

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

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Connections: Fabricate railings with welded connections unless otherwise indicated.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Form changes in direction as follows:
1. By bending or by inserting prefabricated elbow fittings.

I. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of railing members with prefabricated end fittings.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations

in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STEEL AND IRON FINISHES

A. Galvanized Railings:
1. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
3. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 8 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.4 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
   1. Use type of bracket with predrilled holes for exposed bolt anchorage.
   2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:
   1. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.5 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

**END OF SECTION 05 52 13**

# SECTION **06 10 00** - **ROUGH CARPENTRY**

## 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. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Plywood backing panels.

### 1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. RIS: Redwood Inspection Service.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

### 1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

C. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
2. Expansion anchors.
3. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following (Unless otherwise noted on the drawings):
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.

4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide lumber with 19 percent maximum moisture content and the following species and grades: Construction or No. 2 grade lumber of the following species:
1. Western woods; Construction or No. 2 grade lumber; WCLIB or WWPA.
2. Redwood; Construction Common; RIS.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
1. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.
2. Redwood; Construction Common; RIS.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
1. Plywood 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."

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 (18-8) stainless steel.

B. Wood Screws: ASME B18.6.1.

C. Lag Bolts: ASME B18.2.1.

D. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.6 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated on the approved drawings.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.10.1, "Fastening Schedule," in 2016 California Building Code and as shown on the DSA approved drawings.

I. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood.

J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated or redwood (as indicated on drawings), key-beveled lumber not less than 1-1/2 inches wide and of thickness required to

bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

END OF SECTION 06 10 00

# SECTION **06 16 00** - **SHEATHING**

## 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. Wall sheathing.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.

### 1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PANEL PRODUCTS

A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

### 2.2 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 15/32 inch.

### 2.3 FASTENERS

A. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened. Refer to approved structural drawings for additional information.
   1. For wall sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated on approved structural drawings.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Wall Sheathing:
      a. Screw to cold-formed metal framing at spacing shown on approved structural drawings.
      b. Space panels 1/8 inch apart at edges and ends.

**END OF SECTION 06 16 00**

Formatted: Footer distance from edge: 0.5"

# SECTION 06 20 00 – FINISH CARPENTRY

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications section, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Definition: Finish carpentry includes carpentry work, which is exposed to view, is non-structural, and which is not specified as part of other sections.

B. Types of finish carpentry work in this section include:

1. Interior running and standing trim.

C. Builders hardware and wood doors are specified in Division 8 sections.

D. Architectural woodwork is specified in another Division 6 section.

1.3 QUALITY ASSURANCE:

A. Factory-mark each piece of lumber and plywood with type, grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

B. Fire-Retardant Marking: Mark each unit of fire-retardant treated lumber and plywood with classification marking of Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction. Place marking on surfaces, which will not be exposed after installation.

1.4 SUBMITTALS:

A. Samples: Submit samples only when substitutions are being requested.

1. Interior standing and running trim: 2' – 0" x full board or molding width, unfinished.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver finish carpentry materials, until painting, wet work; grinding and similar operations that could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.6 JOB CONDITIONS:

A. Conditioning: Installer shall advice contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity conditions have been stabilized and will be maintained in installation areas.

2. PRODUCTS

2.1 WOOD PRODUCT QUALITY STANDARDS

A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

B. Hardwood Lumber Standards: Comply with National Hardwood Lumber Association (NHLA) rules.

C. Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:

1. Woodwork Institute (WI) "Manual of Millwork."

D. Glued-up Lumber Standard: Comply with PS 56.

2.2 MATERIALS

A. GENERAL:

1. Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.

2. Moisture Content of Softwood Lumber: Provide seasoned (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

3. Moisture Content of Hardwood Lumber: Provide kiln-dried (D) lumber having a moisture content from time of manufacture until time of installation within the ranges required in the referenced woodworking standard.

4. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.

5. Lumber for Painted Finish: At Contractor's option, use pieces, which are either glued-up lumber or made of solid lumber stock.

6. For exterior finish carpentry work use glued-up lumber complying with PS 56 for "wet use" and certified so by respective grading and inspecting agency for species and product indicated.

B. Interior Finish Carpentry

1. Standing and Running Trim for Transparent Finish: Solid stock Alder manufactured to sizes and patterns (profile) shown from selected First Grade Lumber (NHLA); complying with the following grade requirements of referenced woodworking standard, for quality of materials and manufacture: Grade: **Custom.**

2. Standing and Running Trim for Painted Finish: Alder.

a. Grade for Standard Sizes and Patterns: Economy Grade.

b. Grade for Special (Custom) Sizes and Patterns: Custom for quality of materials and manufacture as required in referenced woodworking standard.

2.3 WOOD TREATMENT

A. Preservative Treatment (Trt-Wd): Following basic fabrication provide 3 minute dip treatment of finish carpentry items indicated to receive preservative treatment in 5 % solution of pentachlorophenol, with vehicle which will not interfere with finish application and will produce minimum effect upon appearance. Apply brush coat on surfaces cut after treatment.

B. Fire Retardant Treated Wood (FRTW): Where wood is indicated as "FRTW," provide material complying with applicable standards for pressure impregnation with fire-retardant chemicals and with following requirements.

1. AWPA Standard for Lumber: AWPA C 20 except as otherwise indicated.

2. AWPA Standard for Plywood: AWPA C 27 except as otherwise indicated.

C. Surface Burning Characteristics: Provide materials with surface burning characteristics not exceeding those indicated below when tested in accordance with ASTM E 84 for not less than standard time period (10 minutes).

1. Flame Spread and Smoke Density: Less than 25.

D. For FRTW wood used in interior applications not exposed to relative humidities in excess of 92% use treatment chemicals with reduced hygroscopicity which are non-corrosive to metal fasteners, are non-blooming and permit use of transparent oil-based finishes.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Dricon," Koppers Company, Inc.

"Flameproof LHC," Osmose Wood Preserving Co. of America, Inc.

"Protex," Hoover Universal Wood Preserving Division.

2. Kiln-dry wood after treatment to a maximum moisture content of 15% for plywood, 19% for lumber.

3. Inspect each piece of lumber and plywood or each unit of finish carpentry after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.

3. EXECUTION

3.1 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

3.2 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'0" for plumb and level countertops; and with 1/6" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surface or repair damaged finish at cuts.

D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum lengths of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints.

E. Fire Retardant treated Wood (FRTW): Handle, store and install in accordance with manufacturer's directions and as required to meet required classification or rating. Provide special fasteners, moldings, adhesives and other accessories as tested and listed for type of fire retardant materials indicated.

F. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use the finishing nails or flat-head sheet metal screws for exposed nailings, countersunk, and filled flush with finished surface, and matching final finish where transparent is indicated.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Refer to Division 9 sections for final finishing of installed finish carpentry work.

C. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

**END OF SECTION**

# SECTION **06 20 23** - **INTERIOR FINISH CARPENTRY**

## 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. Interior running and standing trim.

### 1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For adhesives, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For aerosol adhesives, and smaller unit sizes of adhesives, (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.
   3. Product Data: For composite wood products:
      a. Hardwood plywood, particleboard, and medium density fiberboard composite wood products shall meet the requirements for formaldehyde as specified in California Air Resources Board's (ARB) Air Toxics Control Measure (ATCM) for Composite Wood (CCR Title 17, Section 93120, et seq.) Materials not exempted under the ATCM must meet the specified emission limits as shown in GBC Table 5.504.4.5.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:
   1. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
   2. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber, mark grade stamp on end or back of each piece.

C. Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:
   1. The Woodwork Institute (WI) "North American Architectural Woodwork Standards (NAAWS)"

D. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

2.2 INTERIOR TRIM

A. Lumber Trim for Opaque Finish (Painted Finish):
   1. Species and Grade: Alder; B Finish; NHLA.
   2. Maximum Moisture Content: 10 percent.
   3. Finger Jointing: Allowed.
   4. Face Surface: Surfaced (smooth).
   5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
   1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 FABRICATION

A. Kerf backs of the following members except those with ends exposed in finished work:
   1. Interior standing and running trim except shoe and crown molds.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

## 3.2 PREPARATION

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

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

## 3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

## 3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
   1. Install trim after gypsum-board joint finishing operations are completed.
   2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

## 3.5 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

## 3.6 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

## 3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 06 20 23**

# SECTION 06 40 00 – ARCHITECTURAL WOODWORK

1. GENERAL

1.1 RELATED DOCUMENTS

Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of each type of architectural woodwork (A-WdWK) is shown on drawings and in schedules. Woodwork Institute CDS Design numbers are utilized.

B. Types of architectural woodwork include the following:

1. Casework

2. Plastic laminate countertops

3. Decorative Plastic Laminate Wall Panel System

C. Wood Doors are specified within Division 8.

1.3 QUALITY ASSURANCE

A. Qualifications of Fabricators and Installers:

1. For actual fabrication and installation of architectural woodwork, use only personnel who are thoroughly trained and experienced in the products involved and in the recommended methods of their fabrication and installation.

2. In the acceptance or rejection of architectural woodwork, no allowance will be made for lack of skill on the part of workmen.

1.4 SUBMITTALS:

A. Shop Drawings:

1. Within 35 days after award of contract, and before any architectural woodwork is delivered to job site, submit complete Shop Drawings to the Architect for approval in accordance with the provisions of Section 01340 of these Specifications. Shop drawings are required for this section whether or not substitutions are being requested.

2. The “Certified Compliance Grade Stamp” of the Woodwork Institute may be requested. If requested, all fees to Woodwork Institute for initial inspection will be paid by Owner. Any re-inspection and/or correction costs will be borne by Contractor.

B. Samples:

Submit Samples of the laminated plastic to the Architect for approval in accordance with the provisions of Section 01340 of these Specifications, and for the Architect's selection of actual colors and patterns.

C. Mock-up: Provide Full size Mock-up of selected casework (as selected by the architect), which, if approved by the architect, may be installed on the project.

1.5 PRODUCT HANDLING:

A. Protection:

Use all means necessary to protect architectural woodwork before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements:

In any event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

2. PRODUCTS:

2.1 CABINETS:

A. Wood and Grade: Custom Cabinetwork (WI)

Fabricate all custom cabinets to Woodwork Institute standards for "custom grade modular casework," using plastic laminate finish on all exposed surfaces.

B. Design:

1. Cabinetwork will be flush overlay design.

2. Number designations on plans refer to Woodwork Institute CDS design numbers.

C. Hardware:

Provide all cabinet hardware as indicated on drawings and specified by Woodwork Institute modular casework standard and as required for a complete installation. Provide heavy-duty full extension drawer guides of all drawer units.

1. Recessed Monitor Kit: Closet Masters, Inc. Nova, fully-recessed retrofit kit for standard flat panel monitor, including keyboard drawer and viewport glass. 1-800-897-1245 or Closet-Masters.com

2. Coat hook: Ives, Ceiling hook IVBP50A3 (brass) Charles McMurray Co. 1-800-533-0533 Sacramento, CA

3. Drawer Pulls: U-shaped wire, fully accessible.

4. Hinges: National #B851

D. Finishing:

Site finish or pre-finish all cabinets to the requirements stated in Section 09900 of these Specifications.

2.2 COUNTERTOPS

A. Types and Sizes:

1. Shop fabricate all countertops and splashes to the types and sizes indicated on the Drawings.

2. Provide cove at backsplash and rolled edge at fronts, except as detailed.

3. Provide chemical resistant countertop and backslash where shown on plans and in all science classrooms.

B. Coverings:

Finish surfaces of all faces, countertops and backsplashes shall be one of the following plastic laminates, or an equal approved in advance by the Architect, in colors and patterns selected by the Architect from the standard range of colors and patterns of the approved manufacturer.

1. ENJAY FIBER & LAMINATES COMPANY
P.O. BOX 1312
LOS GATOS, CALIFORNIA 95030 “NEVAMAR”

2. FORMICA CORPORATION
1753 SABRE ST.
HAYWARD, CALIFORNIA 94545 “FORMICA”

3. RALPH WILSON PLASTIC CO.
1753 SABRE ST.
HAYWARD, CALIFORNIA 94545 “WISLONART”

C. Plastic Laminates: Provide high-pressure laminated plastic in patterns and colors selected by the Architect from standard patterns and colors of products approved for use in this Work, and complying with NEMA LD3 in the following minimum thickness.

| | |
|---|---|
| Horizontal surfaces: | 0.050" |
| Vertical surfaces: | 0.028" |
| Post forming: | 0.042" |
| Self-edge bands: | 0.028" |
| Cabinet liners: | 0.020" |
| Backing sheets: | 0.020" |

2.3 PLASTIC LAMINATE DECORATIVE WALL SYSTEM:

A. Manufacturers:

1. Construction Specialties, Inc.
725 Twin Oaks Valley Road
San Marcos, CA 92069

(619) 744-0300 / Fax (619) 744-7603

2. Custom Plastics
1128 D Sibley Street
Folsom, CA 95630
(530) 662-0860 (Jeff Miller)

B. Product:

1. Wall Panel System "CP-3"

C. Features: Square-Edge, 4' x 8'. Install color-matched factory trim in vinyl/acrylic alloy. Refer to plans for layout and installation details. Anchor per plans, and per Manufacturer's printed instructions.

D. Finish/color: One color will be selected from standard Wilsonart, Formica, or Nevamar Plastic Laminate color palette.

2.4 OTHER MATERIALS

All other materials, not specifically described but required for a complete and proper installation of the architectural woodwork, shall be as selected by the Contractor subject to the approval of the Architect.

3. EXECUTION:

3.1 SURFACE CONDITIONS:

A. Field Measurements:

Take all necessary measurements in the field to ensure proper dimensions for cabinets and countertops.

B. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this portion of the Work may properly commence.

2. Verify that architectural woodwork may be fabricated and installed in complete accordance with the original design, approved Shop Drawings, and reference standards.

C. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FABRICATION

Fabricate all cabinets and countertops in strict accordance with the approved Shop Drawings and the referenced standards.

3.3 INSTALLATION

A. Install all cabinets and countertops, square plumb, level and firmly anchored for long life under hard use.

3.4 FINAL INSPECTION

A. General:

Prior to final inspection and acceptance by the Architect, completely check each installed item and adjust for proper operation.

B. Compliance:

1. The Owner reserves the right to request and pay for an inspection by a representative of the Woodwork Institute to determine that all work of this Section has been performed in accordance with the referenced standards.

2. In the event such inspection determines that architectural woodwork, or any part of it, does not comply with the referenced standards, the Contractor shall pay all costs of the initial inspection and all subsequently required re-inspections, and shall immediately remove all non-complying woodwork and replace with new woodwork complying with the referenced standards and these Specifications, all at no additional cost to the Owner.

**END OF SECTION**

# SECTION 06 41 00 – ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Custom fabricated casework.
   1. Countertops.
   2. Cabinet hardware.
   3. Preparation for installation of equipment and utilities.

1.2 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Section 08 81 00 – Glass Glazing.

1.3 RELATED SECTIONS

A. Section 06 10 00 – Rough Carpentry.

B. Section 07 92 00 – Joint Sealants.

C. Section 09 22 16 – Non-Structural Metal Framing.

D. Section 09 91 00 – Painting.

E. Divisions 21-23 Sections, as applicable to Work of this Section.

F. Divisions 26-28 Sections, as applicable to Work of this Section.

1.4 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Sections 01 42 00 for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:
   1. ANSI 135.4 – Basic Hardboard.
   2. ANSI A208.2 – Medium Density Fiberboard for Interior Applications.
   3. ANSI/BHMA 156.9 – Cabinet Hardware.
   4. NEMA LD3 – High-Pressure Decorative Laminates.
   5. PS 1-95 – Construction and Industrial Plywood.
   6. PS 20-99 – American Softwood Lumber Standard.
   7. Architectural Woodwork Standards (AWS), 1st Edition, October 1, 2009; Joint Publication of AWI, AWMAC (Canada), and WI (California).

## 1.5 SYSTEM DESCRIPTION

A. Casework design and construction shall be in accordance with Architectural Woodwork Standards (AWS), as follows:

1. Grade: Premium.
2. Construction Style: A – Frameless.
3. Construction Type: Type I – Multiple Self Supporting Units.
4. Door and Drawer Front Style: Flush overlay.
5. Shelves: Conform to AWS requirements, subject to a 50 psf uniformly spaced load not to exceed 200 pounds per shelf.
6. Provide seismic anchorage in accordance with 2007 California Building Code (CBC).

## 1.6 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00. Begin fabrication only after required approvals have been obtained.

B. Shop Drawings: Comply with Section 1 “Submittals” of Architectural Woodwork. Submit as follows:

1. Submit 2 copies of shop drawings (11 inch by 17 inch minimum size).
2. Drawings indicate form and profile concept only. Submit shop drawings to illustrate Fabricator’s understanding of Drawings and to show intended fabrication details. A photocopy or traced copy of Drawings is not acceptable as shop drawing.
3. Prepare shop drawings using field verified dimensions. Report any major discrepancies between Drawings and field dimensions before fabrication of work.
4. Indicate casework conditions, identified with location, grade, type of finish, and wood species.
5. Show casework in relation to adjacent construction with sectional drawings at full size or at 3 inch to 1 foot scale.
6. Coordinate dimensions of built-in equipment and fixtures. Show casework hardware indicating brand name and model used.
7. Show special accessory components not included in manufacturer’s product data.
8. Show anchoring and attachment method. Show seismic restraint in accordance with CBC. Show method of scribing.
9. Furnish an AWS Certified Compliance Label on shop drawings as specified in this Section.

C. Samples: Submit finish samples as follows:

1. Two 6 inches by 12 inches samples of each cut and species of lumber and plywood.
2. Two 6 inches by 12 inches countertop sample.
3. One sample each of cabinet hardware.

D. Quality Assurance/Control Submittals: Submit the following in accordance with appropriate provisions of this Section:

1. Manufacturer qualifications.
2. Installer qualifications.

3. AWS Compliance Certification.

1.7 QUALITY ASSURANCE

A. Owner's Requirements: Single source fabrication and installation is required for Work of this Section.

B. Qualifications:

1. Manufacturer Qualifications: Firm specializing in manufacturing products specified in this Section with a minimum 5 years experience.
2. Installer Qualifications: Firm specializing in installing work specified in this Section acceptable to manufacturer with experience on at least 5 projects of similar nature in past 3 years.

C. Certification Requirements:

1. AWS Compliance Certification: Submit documentation indicating that millwork products furnished and installed meet all requirements of AWS Grades specified.
2. AWS Certified Compliance Label: Show AWS Certified Compliance Label on first page of each set of shop drawings.

D. Pre-Installation Meetings

1. Conduct pre-installation meeting in accordance with Section 01 30 00.
2. Convene pre-installation meeting prior to commencing work of this Section.
3. Coordinate work in this Section with work in related Sections. Coordinate work with plumbing and electrical rough-in. Ensure orderly and efficient sequencing of installation of interdependent trades, construction elements, and include provisions for future work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 60 00.

B. Deliver materials and manufactured products only when the area is ready for installation, broom clean, totally enclosed, and relative humidity is 50 percent or less at 70 degrees F.

C. Storage and Protection: Store materials in a dry secure place. Protect from weather, surface contaminants, construction traffic, and other potential damage.

1.9 MAINTENANCE DATA

A. Submit in accordance with Section 01 70 00.

B. Provide cleaning and maintenance information. Include hardware adjustment information.

PART 2 PRODUCTS

2.1 LUMBER

A. Lumber: Conform to PS 20; Premium Grade in accordance with Architectural Woodwork Standards, Section 3. Dimensions as shown on Drawings. Properties as follows:

1. Moisture Content: Kiln dried; moisture content 6 percent to 12 percent.
2. Wood Species:

| Use | Species |
|---|---|
| Framing, internal construction. | Douglas Fir |
| Standing or running trim casework components. | Birch |

2.2 WOOD BASED PANELS

A. Formaldehyde emissions of wood-based panels shall not exceed limits established by the Department of Housing and Urban Development (HUD) and 24 CFR, Section 3208.308. Products containing urea-formaldehyde resins shall not be allowed.

B. Hardwood Plywood: Balanced construction, veneer-core plywood: Grade AA in accordance with Architectural Woodwork Standards, Section 4. Nominal thickness shall be as indicated in this Section and as shown on the Drawings.

1. Basis-of-Design Product: Green T Veneer Core hardwood plywood by Timber Products Company, Springfield, OR; 800-547-9520, www.timberproducts.com. Provide named product or accepted equal.
2. Substitutions: Comply with requirements of Section 01 60 00 and 01 81 13. Specified product is critical to achievement of CHPS Goals. Proposed substitutions not meeting CHPS criteria will not be considered.

C. Softwood Plywood: Veneer-core plywood; conforming to PS 1, Exposure 1, Grade A-A, Group 1. Nominal thickness shall be as specified and as indicated on Drawings.

D. Medium Density Fiberboard (MDF): Meets or exceeds ANSI A208.2, Class MD, minimum 45 lbs/ft$^3$.

1. Basis-of-Design Products:
   a. Non-Fire Rated Applications: Arreis Sustainable Design Fiberboard by Sierra Pine, Roseville, CA; 800-676-3339, www.sierrapine.com.
   b. Fire Rated Applications: Medite II Medium Density Fiberboard by Sierra Pine, Roseville, CA; 800-676-3339, www.sierrapine.com.
   c. High Moisture Applications: Medex Medium Density Fiberboard by Sierra Pine, Roseville, CA; 800-676-3339, www.sierrapine.com.
2. Substitutions: Comply with requirements of Section 01 60 00 and 01 81 13. Specified products are critical to achievement of CHPS Goals. Proposed substitutions not meeting CHPS criteria will not be considered.

E. Hardboard: ANSI 135.4, Class 1 – Tempered; smooth-one-side (S1S), minimum 60 lbs/ft$^3$.

F. Thermally Fused Melamine: Thermoset decorative overlays pre-laminated to substrate (hardboard or MDF, as specified in this Section) by thermal fusion; meets or exceeds requirements of NEMA LD3, General Purpose Type and Cabinet Liner Type, as applicable.

G. Particle Board: Use of particle board is not permitted in architectural wood casework.

2.3 PLASTIC LAMINATE

A. Manufacturers:

1. Basis-of-Design Products: By Wilsonart International, Temple, TX; 800-433-3222, www.wilsonart.com. Provide products by named manufacturer or accepted equal by one of the following.

   a. Nevamar Decorative Surfaces, Odenton, MD; 410-551-5000, www.nevamar.com.

   b. Formica Corporation, Cincinnati, OH; 800-729-8956, www.formica.com.

   c. Or accepted equal.

2. Substitutions: Conform to Section 01 60 00.

B. High-Pressure Decorative Laminates: NEMA LD3; grades and thickness as follows:

| Use/Application | NEMA LD3 Grade | Min. Thickness |
|---|---|---|
| Horizontal surfaces where postforming is not required. | HGS or HGL | 0.048 inch ± 0.005 inch |
| Exposed vertical surfaces of casework components where postforming is not required. | VGS | 0.028 inch ± 0.004 inch |
| Cabinet liner. | CLS | 0.020 inch |
| Backing sheet. Provide at backside of plastic laminated panel substrates to enhance dimensional stability where laminate finish is applied to only one surface. | BK | 0.020 inch |

C. Colors: As indicated on Drawings, where not indicated, as selected by Architect from manufacturer's full range of colors.

2.4 SOLID SURFACING MATERIAL (SSM)

A. Products and Manufacturers:

1. Basis-of-Design Product: Corian® by Corian Solid Surfaces, Terra Collection, a division of DuPont, Wilmington, DE; 800-426-7426, www.corian.com. Provide named product or accepted equal by one of the following:

   a. Avonite Solid Surfacing by Aristech Acrylics LLC, Belen, NM; 800-428-6648, www.avonite.com.

2. Substitutions: Conform to Section 01 60 00.

B. Solid Surfacing Material (SSM): Non-porous homogeneous blend of acrylic or polyester alloys and fillers creating a solid surfacing material. Color and pattern shall extend throughout the material.

1. Recycled content: Minimum 6 percent pre-consumer.
2. Thickness: 1/2 inch, unless otherwise indicated on Drawings.
3. Color: As indicated on Drawings, if not indicated, to be selected by Architect from manufacturer's full range of colors.

C. Solid Surfacing Material Accessories:

1. Joint Adhesive: Manufacturer's standard 2-part adhesive kit to create inconspicuous non-porous joints, with a chemical bond.
2. Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive.
3. Sealant: Manufacturer's standard mildew resistant, FDA and UL recognized silicone sealant in color matching or clear formulations.

2.5 ACCESSORIES

A. Acrylonitrile-Butadiene-Styrene (ABS) Edge Banding for Drawer Fronts and Doors:

1. GreenLine™ ABS Edgebanding by Doellken-Woodtape, Mississauga, Ontario, Canada, 800-461-0061, or accepted equal.
   a. Width: As indicated on Drawings.
   b. Thickness: 1/8 inch.
   c. Color: As selected by Architect.

B. Fasteners: Nails, screws, and other fasteners of size and type best suitable for the purpose. Staples, screws or T-nails not permitted at exposed surfaces. Staples and nails not permitted in casework joinery.

C. Adhesives, Caulks, and Sealants:

1. Adhesives and sealants shall meet VOC requirements of local Air Quality Management District.
2. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24);
   a. Wood Glues: 30 g/L.
   b. Contact Adhesive: 250 g/L.
3. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance.
4. Wood Joinery: CS 35-61 Type II (water-resistant). Shall withstand cold-soak tests specified in PS 51-71.
5. Laminate Adhesive: Water-based contact adhesive, type recommended by plastic laminate manufacturer.
6. Caulk: 100 percent clear silicone – use to fill voids and joints between laminated components and adjacent surfaces.
7. Sealant: Mold and mildew resistant; type and composition recommended by substrate manufacturer to provide a moisture barrier at sink cutouts and other locations where unfinished substrate edges may be subjected to moisture.

D. Glass: Refer to Section 08 81 00.

2.6 CABINET HARDWARE

A. Hardware shall be furnished and installed as required to provide a complete and operable casework installation. Hardware shall conform to ANSI/BHMA 156.9 Grade 2, except where a higher grade is specified.

B. Acceptable Manufacturers:

1. Accuride International, Inc., Santa Fe Springs, CA; 888-459-8624; www.accuride.com.
2. Amerock Corp., Rockford, IL; 800-618-9559; www.amerock.com.
3. CompX Security Products, Mauldin, SC; 864-297-6655, www.compxnet.com; or accepted equal. (Western Distribution Center, Rancho Cucamonga, CA; 909-476-7933.)
4. Doug Mockett & Co., Inc., Manhattan Beach, CA; 800-235-7743; www.mockett.com.
5. EPCO – The Engineered Products Co., Flint, MI; 810-767-2050; www.epcohardware.com.
6. Häfele America Co., Archdale, NC; 336-889-2322; www.haefele.com.
7. Hettich America L.P., Alpharetta, GA; 800-438-8424; www.hettichamerica.com.
8. Grass America, Inc., Kernersville, NC; 800-334-3512; www.grassusa.com.
9. Knape & Vogt Mfg. Co., Grand Rapids, MI; 800-253-1561; www.knapeandvogt.com.
10. CompX International Inc., Dallas, TX; 864-297-6655; www.compx.com.
11. Olympus Lock, Inc., Seattle, WA; 800-525-0954; www.olympus-lock.com.
12. RPC – Rockford Process Control, Rockford, IL; 815-966-2000; www.rockfordprocess.com.
13. Terry Hinge & Hardware, Van Nuys, CA; 800-228-3779; www.terryhinge.com.
14. Substitutions: Conform to Section 01 60 00 requirements.

C. Pocket Door Hinges:

1. Acceptable Products: Accuride Model No. 123, Part No. CB123-22; or accepted equal.

D. 5-Knuckle Overlay Hinges:

1. Chrome; powder coat finish. Product: RPC No. 374-P28-B, Häfele Aximat SM, or accepted equal.

E. Wire Pull: 3-3/4 inch x 1-3/8 inch x 5/16 inch diameter steel wire pull; nickel-plated matt finish. Product: Häfele Cat. No. 116.07.622, or accepted equal.

F. Drawer Slides:

1. Pencil Drawers:
   a. Full extension; steel ball bearings; hold-in detent; silenced in and out; low profile; 1/2 inch side space; minimum 50 lbs rated load.
   b. Acceptable Products: Accuride Model No. 2632.
2. Box Drawers: 1 inch over travel; steel ball bearings; hold-in detent; progressive movement; 1/2 inch side space; 100 lbs rated load. Product: Accuride Model No. 7432.

3. File Drawers (up to 24 inches wide): Minimum 1 inch over travel; steel ball bearings; hold-in detent; progressive movement; 1/2 inch side space; 150 lbs rated load. Product: Accuride Model No. 4032.
   a. File Drawer Guide: Product: Accuride Model 3640, load rating 200 lbs.,length to match drawers.

G. Adjustable Shelf Supports: ANSI/BHMA 156.9 Grade 1; nickel plated steel shelf supports.
   1. 5mm Steel Pin: MC5MM26.
   2. 5mm Steel Earthquake Pin: VASA #2-7875-104.

H. Countertop Bracket: Steel; gray primed; load capacity 1100 lbs per pair. Product: Häfele Hebgo bracket Cat. No. 287.45.4XX, or accepted equal.

I. Cabinet Locks: Each classroom shall have cabinets keyed alike, and differently from cabinets of other classrooms. A master key shall be provided for cabinets of all classrooms.
   1. Single Door Locks: Disc tumbler cylinder cam locks. 90 degree cam turn, key removable in both locked and unlocked positions. Cylinder length – 1-3/16 inch. Maximum material thickness – 7/8 inch.
      a. Acceptable Products: Olympus 100-26D78MK, dull chrome finish.
   2. Double Door Locks: Surface-mounted lock for locking two adjacent doors; 180 degrees cam rotation; turn counter clockwise (CCW) to lock; key removable in both locked and unlocked position. Top cam setback 3/16 inch, top cam extension 29/32 inch, side cam setback 3/32 inch, side cam extension 29/32 inch, and cam throw 1/2 inch.
   3. Provide metal magnetic catches at cabinet doors.

J. Cable Grommets: 2-1/2 inch diameter plastic grommet; black color. Product: Doug Mockett & Co. Model EDP (flip-top tab), Häfele Cat. No. 429.99.324 (spring-loaded rotating segment in cover), or accepted equal.

K. Ventilation Grills: 9-1/16 inch wide by 2-11/16 inch high by 8mm deep plastic air ventilation grill with flanged rim; color: chrome plated; Hafele item number: 571.54.248.

L. Wardrobe Rail: 1-15/16-inch diameter by 8 foot long aluminum tube, anodized, matt finish, Hafele item number: 801.42.900.
   1. Rail supports: Zinc plated, matt aluminum finish, with two pins for 5mm holes, Hafele item number: 803.56.900.

M. Keyboard Arm Assembly: Black epoxy coated steel keyboard arm, 22-3/4-inch length, with keyboard tray set, gel foam wrist rest and portable mouse tray. Hafele item number: 632.68.331.

N. Table H-Leg Assembly: Black, textured, epoxy coated steel, Hafele item number: 635.73.301.

## 2.7 FABRICATION

A. Fabricate and assemble casework components at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed AWS grade requirements as indicated in this Section.

B. Closely fit casework at site. Provide filler inserts and trim where necessary, scribe for a tight fit.

C. Provide cutouts for inserts, grommets, and fittings. Install grommets where indicated on Drawings after site verification of locations and dimensions. Seal surfaces of cut edges.

D. Plastic Laminates:

1. Apply plastic laminate in full uninterrupted sheets, consistent with manufactured sizes.
2. Fit corners and joints hairline. Slightly bevel arises.
3. Secure plastic laminated panels with concealed fasteners.
4. Apply laminate backing sheets to reverse side of panels with high-pressure decorative laminates on one face.

E. Sheet Materials Application:

| Use/Application | | Thickness | Wood-Based Panel |
|---|---|---|---|
| Casework carcass. | | Min. 3/4 inch | Plywood or MDF |
| Doors and drawer false fronts. | | 3/4 inch | Plywood or MDF |
| Drawer box. | Sides, backs, & subfronts. | Min. 1/2 inch, Max. 5/8 inch | Plywood or MDF |
| | Bottom. | Min. 1/4 inch | Hardboard or MDF |
| Cabinet backs. | | Min. 1/4 inch | Hardboard or MDF |
| Laminate clad countertops. | | Min. 3/4 inch | Plywood or MDF |
| Shelves: up to 32 inch span. | | Min. 1 inch | Plywood or MDF |
| Shelves: 32 inch up to 49 inch | | Min. 1 inch | Plywood |

F. Casework Carcass:

1. Glue frame components together. Brace top corners, bottom corners and cabinet bottoms with hardwood blocks, or metal or plastic braces.
2. Joinery Method: Acceptable joinery methods shall be as follows:
   a. Tops, exposed ends, and bottoms:
      1) Steel European assembly fasteners 1-1/2 inch from end, 5 inch on center. Fasteners shall not be visible on exposed surfaces.
      2) Doweled and glued under pressure – approximately 4 dowels per 12 inches of joint.
      3) Stop dado, glued under pressure, and either nailed, stapled or screwed. Fasteners shall not be visible on exposed surfaces.
      4) Spline or biscuit and glued under pressure.
   b. Cabinet Backs (Wall Hung Cabinets):
      1) Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanism should transfer the load to case body members.
      2) Fabrication Method: Full bound, capture in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves, glued and fastened to top and bottom.

G. Drawer Assembly:
   1. Drawer box with drawer false front.
   2. Acceptable Joinery Methods:
      a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.
      b. Doweled, glued under pressure.
      c. Lock shoulder, glued and pin nailed.
      d. Bottoms shall be set into sides, front, and back, 1/4 inch deep groove, with a minimum 3/8 inch standing shoulder.
   3. File Drawers: Unless otherwise indicated, direction of file folders shall be parallel to drawer door. Provide adequate, clear inside dimensions for hanging file folders. Minimum clear inside drawer dimensions shall be as follows:
      a. Letter size file folders: Minimum 13-1/4 inch wide by 10-1/2 inch high.
      b. Legal size file folders: Minimum 16-1/4 inch wide by 10-1/2 inch high.

H. Shelving:
   1. Fixed Shelves: Dadoed or doweled into cabinet sides.
   2. Adjustable Shelves: 0.197 inch bore holes at 1-1/4 inch on center.

I. Laminate Countertops and Backsplash:
   1. Edge Style: 1-1/2-inch waterfall self edge with 1/2-inch radius.
   2. 6 inch integral coved backsplash with square edge.
   3. Substrate shall be moisture-resistant where countertops receive sinks and lavatories, or are exposed to liquids.

J. Solid Surfacing Material Countertops and Backsplash:
   1. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   2. Fabricate tops with shop-applied edges of materials and configuration indicated.
   3. Fabricate tops with shop-applied backsplashes.
   4. Drill holes in countertops for plumbing fittings and cable grommets in shop.

2.8 FINISHES

A. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning, and polishing until after installation.
   1. Comply with Architectural Woodwork Standards, Section 5 requirements.

B. Plastic Laminate Finish: Provide casework finishes as follows:
   1. Drawer Box: Thermally fused melamine.
   2. Semi-Exposed Surfaces (As defined in Architectural Woodwork Standards, Section 10):
      a. Cabinet with Doors: Thermally fused melamine.
      b. Cabinets with Open Shelves: High-pressure decorative laminate.

3. Exposed Surfaces (as defined in Architectural Woodwork Standards, Section 10): High-pressure decorative laminate with ABS edge banding.
4. Doors and Drawer False Fronts: High-pressure decorative laminate with ABS edge banding.
5. Exposed Interior Surfaces (as defined in Architectural Woodwork Standards, Section 10): High-pressure decorative laminate.

C. Solid Surfacing Material (SSM) Finish: As standard with manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements, dimensions, location and layout.

B. Verify location and sizes of utility rough-in associated with work of this Section.

C. Verify adequacy of backing and support framing.

D. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with accepted shop drawings and with applicable AWS grade requirements as indicated in this Section.

B. Installation shall be done in humidity and temperature controlled environment, in accordance with AWS recommendations.

C. Install fabricated assemblies, level, plumb, square, and true to line, in locations as shown on Drawings. Attach and anchor securely to the floor and walls with mechanical fasteners appropriate for the substrate.

D. Use concealed fasteners to attach and secure casework components, countertops, and plumbing fixtures.

E. Carefully scribe casework abutting other components with a maximum gap of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Install solid surfacing material per manufacturer’s instructions.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

G. Install cable grommets in countertops at all casework knee-spaces and where shown on Drawings. Verify locations with Owner.

3.3 ADJUSTING

A. Adjust moving or operating parts for smooth, uniform operation.

B. Drawer slides shall be adjusted such that the drawer does not act as the stop.

3.4 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage finish surface or surrounding construction

END OF SECTION

# SECTION **06 41 16** - **PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS**

## 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. Plastic-laminate-faced architectural cabinets.
2. Plastic-laminate countertops.
3. Solid-surface-material window sills.
4. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:
1. Section 05 40 00 “Cold-Formed Metal Framing” for metal stud backing concealed within other construction before cabinet installation.
2. Section 05 50 00 “Metal Fabrications” for steel framing and support of countertops.
3. Section 06 10 00 “Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

### 1.3 SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and cabinet hardware and accessories.

B. California Green Building Standards Code (GBC) Submittals:
1. Product Data: For composite wood products:
   a. Hardwood plywood, particleboard, and medium density fiberboard composite wood products shall meet the requirements for formaldehyde as specified in California Air Resources Board’s (ARB) Air Toxics Control Measure (ATCM) for Composite Wood (CCR Title 17, Section 93120, et seq.) Materials not exempted under the ATCM must meet the specified emission limits as shown in GBC Table 5.504.4.5.

C. Shop Drawings: Show location of each item, dimensioned plans, elevations, and sections, large-scale details, attachment devices, and other components.
1. Submit shop drawings in conformance with the requirements of North American Architectural Woodwork Standards.
2. Drawings indicate form and profile concept only. Submit shop drawings to illustrate Fabricator’s understanding of Drawings and to show intended fabrication details. A photocopy or traced copy of Drawings in not acceptable for shop drawings.
3. Prepare shop drawings using field verified dimensions. Report any major discrepancies between Drawings and field dimensions before fabrication of work.

4. For the initial review submit two copies of shop drawings to Architect (11 inch by 17 inch minimum size.) PDF's are acceptable for initial review.
5. Show details full size.
6. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
7. Show anchoring and attachment method and coordinate with DSA approved details shown on the Drawings.
8. Show method of scribing.
9. Coordinate dimensions of built-in equipment and fixtures.
10. Show casework hardware indicating brand name and model used.
11. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
12. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, electrical switches and outlets, and other items installed in plastic-laminate countertops.
13. Show special accessory components not included in manufacturer's product data.
14. Apply WI Certified Compliance Program label to Shop Drawings.

D. Samples for Verification:
1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
4. Solid-surface-material, 6 inches square for each color.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Qualification Data: For Installer and Fabricator.

F. Product Certificates: For each type of product.

G. Woodwork Quality Standard Compliance Certificates: Woodwork Institute (WI) Certified Compliance Program certificates.
1. Before delivery to the jobsite the woodwork supplier shall provide a Woodwork Institute Certified Compliance Certificate indicating the millwork products being supplied and Certifying that these products fully meet the requirements of the Grade or Grades specified.
2. Each elevation of casework, each laminated top, and each solid surface top shall bear a Woodwork Institute Certified Compliance Label.
3. At completion of installation the woodwork installer shall provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and Certifying that the installation of these products fully meets the requirements of the Grade or Grades specified.
4. All fees charged by the Woodwork Institute for their Certified Compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.

## 1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Fabricator of products or Licensee of WI's Certified Compliance Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets and countertops until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets and countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

B. Cabinets and countertops shall acclimate in spaces where they will be installed a minimum of 72 hours before installation.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets and countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets and countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets and countertops by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets and countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. Number designations on plans refer to WI Casework Design Series (CDS) numbers in Appendix A of the latest Architectural Woodwork Standards.

3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. Construction Style: A – Frameless.

D. Construction Type: Type I – Multiple Self Supporting Units.

E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

F. Core Thickness: 3/4 inch, unless otherwise noted.

G. Shelves: Conform to NAAWS requirements, subject to a 50 psf uniformly spaced load not to exceed 200 pounds per shelf.
   1. Shelves deeper than 24 inches shall have three supports at each end of shelf.
   2. Shelves greater than 24 inches in length shall be at least 1 inch thick. Refer to North American Architectural Woodwork Standards for length limitations of 1 inch thick material and utilize appropriate shelf material for length of cabinets detailed and shown on drawings.

H. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Wilsonart International; Div. of Premark International, Inc.
      b. Abet Laminati, Inc.
      c. Formica Corporation.
      d. Lamin-Art, Inc.
      e. Panolam Industries International, Inc.

I. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGL.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: Grade VGS.
   5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

J. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
      a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
      b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
      c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
   2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
   3. Drawer Bottoms: Thermoset decorative panels, 1/2 inch thick (minimum).

K. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

L. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

M. Drawer Construction:
1. Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
2. Acceptable Joinery Methods:
   a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.
   b. Doweled, glued under pressure.
   c. Lock shoulder, glued and pin nailed.
   d. Bottoms shall be set into sides, front, and back, 1/4 inch deep groove, with a minimum 3/8 inch standing shoulder.
3. File Drawers: Unless otherwise indicated, direction of file folder shall be parallel to drawer door. Provide adequate, clear inside dimensions for hanging file folders. Minimum clear inside drawer dimensions shall be as follows:
   a. Letter size file folders: Minimum 13-¼ inch wide by 10-½ inch high.
   b. Legal size file folders: Minimum 16-¼ inch wide by 10-½ inch high.

N. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from laminate manufacturer's full range in the following categories:
   a. Solid colors, matte finish.
   b. Wood grains, matte finish.
   c. Patterns, matte finish.

## 2.2 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
1. Provide labels and certificates from WI certification program indicating that countertops, including installation, comply with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS or HGP.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Wilsonart International; Div. of Premark International, Inc.
   b. Abet Laminati, Inc.
   c. Formica Corporation.
   d. Lamin-Art, Inc.
   e. Panolam Industries International, Inc.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by manufacturer's designations.
2. Match Architect's sample.
3. As selected by Architect from manufacturer's full range in the following categories:
   a. Solid colors, matte finish.

b. Patterns, matte finish.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard or medium-density fiberboard.

G. Core Material at Sinks: Particleboard made with exterior glue, medium-density fiberboard made with exterior glue or exterior-grade plywood.

H. Core Thickness: 3/4 inch.
1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

## 2.3 SOLID-SURFACE-MATERIAL WINDOW SILLS

A. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. E. I. du Pont de Nemours and Company.
b. Architect and District approved equal.
2. Type: Provide Standard Type.
3. Colors and Patterns: Terra Collection; Silt.

B. Configuration: Provide window sills with the following front style:
1. Front: Straight, slightly eased at top.

C. Window Sills: 1/2-inch- thick, solid surface material.

## 2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde or Grade M-2-Exterior Glue (where called for in other areas of the specifications or on the drawings.)
3. Softwood Plywood: DOC PS 1, medium-density overlay.
4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Butt Hinges: 2-3/4-inch, five-knuckle, grade 1 steel hinges made from 0.095-inch- thick metal, and as follows:
   1. Semi-concealed Hinges for Overlay Doors: BHMA A156.9, B01521. Equal to RPC; #374-P28-B; Chrome Powder Coat Finish.

C. Steel Wire U-Pulls (fully accessible): Back mounted, steel, 5 inches long, 1-1/2 inches deep, and 5/16 inch in diameter. Finish: Nickle-Plated Matte

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports (Display Cabinets and where called for on drawings): BHMA A156.9, B04102; with shelf brackets, B04112.

F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip. Equal to Vasa #2-7875-104

G. Drawer Slides: BHMA A156.9.
   1. Grade 1: Side mounted full-extension type; zinc-plated steel with polymer rollers. Equal to Accuride Model 2632.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides. Equal to Accuride Model 7432 (Grade 1HD-100) and Accuride Model 3640 (Grade 1HD-200).
   3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
   4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
   5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
   6. For computer keyboard shelves, provide Grade 1HD-100.
   7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.

H. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

I. Cabinet Locks: Each room shall have cabinets keyed alike, and differently from cabinets of other rooms. A master key shall be provided for all cabinets in the building. 5 pin cylinder master keyed to MK 99699. Provide a minimum of 4 matching keys per room with Architectural Cabinets and 4 copies of the master keys for the building.
   1. Door Locks: BHMA A156.11, E07121. Equal to Olympus Lock, Inc.; #100-26D78MK; dull chrome finish.
   2. Drawer Locks: BHMA A156.11, E07041. Equal to Olympus Lock, Inc.; #200-26D78MK; dull chrome finish.

J. Door Silencers: BHMA A156.16, L03011. Drawer Silencers are not allowed. Closing stops for drawers are to be provided at the rear of the both drawer sides, unless closing stops are built into the slides to prevent drawer front from impacting the cabinet body.

K. Grommets for Cable Passage through Countertops: 2-½ inch OD black, molded-plastic grommets and matching plastic caps with slot for wire passage.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Provide anchorage as indicated in drawings.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.7 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide units with smooth surfaces in uniform plane, free of defects. Provide front and end overhang of 1 inch over base cabinets.

C. Fabricate solid-surface-material window sills in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets and countertops to average prevailing humidity conditions in installation areas.

B. Before installing cabinets and countertops, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets and countertops to comply with same grade as item to be installed.

B. Assemble cabinets and countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
   1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
   2. Seal edges of cutouts by saturating with varnish except at plumbing fixtures and areas subject to excessive moisture.
   3. Seal edges subject to excessive moisture with a color-toned (for verification), water-resistant sealer before trim or sink rims are installed.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
   1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install cabinets and countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut cabinets and countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Anchor cabinets to anchors or blocking built in or directly attached to substrates as detailed on drawings.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
   3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets as detailed on the Drawings.

I. Solid-surface-material window sills: Anchor securely to support structure as indicated on the drawings.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets and countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the general contractor. Touch up shop-applied finishes to restore damaged or soiled areas.

**END OF SECTION 06 41 16**

# SECTION 06 64 00 – PLASTIC PANELING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Glass-fiber reinforced plastic wall paneling.

1. FRL paneling.
2. FRP paneling.
3. Resin panels.

B. Attachment accessories including cable suspension system, adhesives, sealants, fasteners, trim, and moldings.

### 1.2 RELATED SECTIONS

A. Section 07 92 00 – Joint Sealants.

B. Section 09 29 00 – Gypsum Board.

C. Section 09 65 00 – Resilient Flooring.

D. Section 09 22 16 – Non-Structural Metal Framing.

### 1.3 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
2. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
3. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
4. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D5319 – Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
6. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Provide product data on panels, trim and adhesive.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

D. Shop Drawings: Shop drawings shall include details and erection data associated with the work of other trades; location; materials, profiles, fastenings and accessories.

E. Samples: Submit samples of all interior and exterior trim materials. Samples shall be finished as specified and submitted for color and material approval prior to delivery and installation.

1. Submit two samples 6 inches by 6 inches in size illustrating panel material, color, and finish.

2. Submit two samples 6 inches long in size illustrating trim material, color and finish.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim from a single manufacturer.

B. Regulatory Requirements: Comply with 2007 California Building Code, Chapter 8, “Interior Finishes”, Section 803, “Wall and Ceiling Finishes.”

1. Class A: Flame spread 0-25; smoke-developed 0-450.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

3. Testing Agency: UL.

D. Installation Acceptance: All rejected work shall be removed and replaced at no cost to Owner.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Do not deliver to the job site until suitable storage space is available.

B. Storage, Handling and Protection: Provide all work or materials necessary to store, cover and protect materials specified and installed under this Section. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Prevent marring of finished surfaces and keep materials clean during handling and installation operations. Protect exposed finish work and materials from damage after installation. Replace damaged items at no cost to Owner.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder construction period.

## PART 2 PRODUCTS

### 2.1 FRL PANELS - FIBER-GLASS REINFORCED PLASTIC LAMINATE (FRL) PANELS

A. Basis-of-Design Product: FRL™ fiber reinforced laminate panels by Panolam Industries International, Inc., Shelton, CT, 888-375-9255, www.panolam.com.

1. Provide the named product or accepted equal.
2. Substitutions: Under provisions of Section 01 60 00.

B. Fiberglass Reinforced Plastic Laminate (FRL) Panel System: Provide factory-finished panels, and accessories.

1. Panel Material: Fiber-glass reinforced plastic panels complying with ASTM D5319.
2. Panel Construction: Thermofused melamine overlay, decorative and fire-resistant phenolic paper with fiber reinforcing.
3. Nominal Thickness: 0.088 inch.
4. Surface Finish: Smooth.
5. Color: As indicated on Drawings, if not indicated, to be selected by Architect from manufacturer's full range.
6. Panel Properties:
   a. Wear Resistance: 3,500 per NEMA LD3, Section 2, Test Method 3.13.
   b. Flexural Strength: 25,834 psi per ASTM D790.
   c. Tensile Strength: 19,131 psi per ASTM D638.
   d. Fire-Resistance Rating: Class "A" per ASTM E84; flame spread 25, smoke developed 30.

C. Accessories: Adhesive, trim, sealant, and accessories, as required, and as standard with manufacturer.

### 2.2 FRP PANELS - FIBER-GLASS REINFORCED PLASTIC (FRP) PANELS

A. Basis-of-Design Product: Marlite FR Class1/A panels by Marlite, Dover, OH 330-343-6621, www.marlite.com.

1. Provide the named product or accepted equal by one of the following:
   a. Glasteel, a division of Stabilt America, Inc., www.glsteel.com.
   b. Panolam Industries International, Inc., Shelton, CT; 888-375-9255, www.panolam.com.
   c. Crane Composites Kemlite Company, Inc.; www.kemlite.com www.sequentia.com
2. Substitution: Under provisions of Section 01 60 00.

B. Fiberglass Reinforced Plastic (FRP) Panel System: Provide factory-finished panels, trim, sealant, and accessories.

1. Panel Material: Fiberglass reinforced polyester.
2. Size: 48 inches by 96 or 120 inches by 3/32 inch, as required by design condition; unless otherwise indicated on Drawings.

3. Finish: Gently pebbled, high-gloss.
4. Color: As indicated on Drawings, if not indicated, to be selected by Architect from manufacturer's full range.
5. Panel Properties:
   a. Flexural Strength: 10,000 psi (69 MPa), when tested in accordance with ASTM D790.
   b. Tensile Strength: 7,000 psi (48 MPa), when tested in accordance with ASTM D638.
   c. Impact Resistance: 7.2 ft-lb/in (1260 N/m), when tested in accordance with ASTM D256, Izod method.
   d. Water Absorption: 0.72 percent, when tested in accordance with ASTM D570.
   e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84 (Class A/I).

C. Accessories: Manufacturer's standard adhesive, sealant, and joinery trim system that hides vertical joints and exposed edges.

2.3 RESIN PANELS

A. Basis-of-Design Product: Veritas™ ResinArt Panels by Schneller LLC, Pinellas Park, FL; 877-411-8008, www.veritasideas.com.
   1. Substitution: Under provisions of Section 01 60 00.

B. Resin Panels: Polyester-resin-based sheets bonded to decorative interlayer materials, suitable for indicated application.
   1. Face Sheets: Glycol-modified engineered polyester resin composition.
      a. Recycled Content: Not less than 40 percent.
      b. Sheet Thickness: As indicated on Drawings for each application.
      c. Opacity, Color and Texture: As indicated on Drawings, if not indicated, to be selected by Architect.
      d. Interlayer Materials: Compatible with polyester resin sheet and bonding process to create a solid sheet of material when complete.
         1) Color, Pattern, and Texture: As indicated on Drawings, if not indicated, to be selected by Architect.
      e. Panel Configuration: As indicated on Drawings.

2.4 SUSPENSION SYSTEM FOR RESIN PANELS

A. Basis-of-Design Product: Veritas™ Cable Systemby Schneller LLC, Pinellas Park, FL; 877-411-8008, www.veritasideas.com.
   1. Substitution: Under provisions of Section 01 60 00.

B. Components: Provide stainless steel components for suspending resin panels, as standard with manufacturer, and as listed below:
   1. Cable:
   2. Clamps: Single and double swivels, internally threaded.
   3. Ceiling and Floor Anchors. 6 mm threaded anchors with lock nuts.

2.5 ACCESSORIES

A. Trim and Moldings: Provide metal or PVC trim and moldings, as indicated on Drawings.

1. Metal Trim and Moldings: Aluminum, type as selected by Architect.

a. Acceptable Manufacturer: Nudo Products, Inc., Springfield, IL; 800-826-4132, www.nudo.com; or accepted equal.

b. Finish: Clear, anodized.

2. PVC Trim, Base, and Moldings: Manufacturer's standard trim system, base, and moldings that hide vertical joints and exposed edges.

a. Panel Trim, Molding, and Corners: Extruded PVC; color to match panel color; provide as required.

b. Panel Base: Rigid extruded PVC with integral color; 4 inches wide; color as selected by Architect. Provide connectors, end caps, inside and outside corners as required.

B. Adhesive: As recommended by plastic paneling manufacturer.

C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with applicable requirements in Section 07 92 00.

1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Acceptable Manufacturer: Color Rite, Inc., Yukon, OK; 405-354-3644, www.colorriteinc.com; or accepted equal.

3. Color: To match panel color.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Sand substrate high spots and fill low spots as required to provide flat and even surface for panel installation.

B. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

C. Surfaces to receive FRP shall be prepared in strict accordance with manufacturer's printed instructions and as specified herein. Fill pinholes, cracks and other surface imperfections with spackle and scrape off surface splatters and imperfections to leave substrate smooth and free of damage.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints as indicated on Drawings.

F. Other trade work that penetrates the substrate shall be completed before beginning FRP panel application.

3.3 INSTALLATION

A. Verify Drawings for panel location, layout, and treatment of perimeter conditions.

B. Install plastic paneling in accordance with manufacturer's printed instructions.

1. Installation with Adhesive: Install panels in a full spread of adhesive. Remove excessive adhesive from exposed and finished surfaces immediately.

2. Installation with Cable, Fasteners, and Fittings: Install panels with cables, fitting, and fasteners, as indicated on Drawings. Layout fitting locations and mark on face of panels so that fittings are accurately aligned.

C. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant, when recommended by panel manufacturer.

D. Install panel system level, plumb, and true.

E. Provide a smooth, straight, solid and clean wall surface.

F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures.

G. Install trim as shown and as required for a complete, finished system.

H. Install trim in longest practicable lengths. “Piecing” of trim is not permitted.

I. Ensure positive contact of FRP panels to adhesive and wall surfaces. Remove and replace damaged or improperly applied panels.

3.4 CLEAN-UP

A. General: Keep the premises in a neat, safe and orderly condition uring execution of this portion of the work.

B. Clean-up: Upon completion of the work of this Section, remove all surplus materials, rubbish and debris from the premises and leave it "broom clean."

END OF SECTION

# SECTION 06 64 01 - FIBER-REINFORCED LAMINATES

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. Fiber-reinforced laminates (FRL) for wall applications.

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board."

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature including product characteristics, accessories, and limitations.

B. California Green Building Standards Code (GBC) Submittals:

1. Product Data: For composite wood products:

a. Hardwood plywood, particleboard, and medium density fiberboard composite wood products shall meet the requirements for formaldehyde as specified in California Air Resources Board's (ARB) Air Toxics Control Measure (ATCM) for Composite Wood (CCR Title 17, Section 93120, et seq.) Materials not exempted under the ATCM must meet the specified emission limits as shown in GBC Table 5.504.4.5.

2. Product Data: For adhesives, documentation indicating that products:

a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2013 California Green Building Standards Code).
b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.

3. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):

a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

4. Product Data: For sealants, sealant primers, and caulks, documentation indicating that products:

a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2013 California Green Building Standards Code).
b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.

5. Product Data: For smaller unit sizes of sealant, sealant primer, or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):

a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Submit Samples of colors and finishes if requested by Architect.

D. Samples for verification for plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

E. Qualification Data: For Installer.

F. Product Certificates: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicate where materials were delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.

1. FRL Wall Panels: Full-size panels equal to 2 percent of quantity installed.
2. Aluminum Profiles (Trim): Quantity of each exposed component equal to 1 percent of quantity installed.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum of 5 years experience manufacturing similar products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. Provide manufacturer's standard warranty against defects in manufacturing.

PART 2 - PRODUCTS

2.1 FIBER-REINFORCED LAMINATES

A. Manufacturer: Panolam Industries International, Inc., 20 Progress Drive, Shelton, CT 06484. Tel: 888-375-9255. Web: www.panolam.com.

B. FRL Panels shall comply with the following:

1. Thickness: 0.075 inches

2. Color and Finish: Pionite Palette: FA521-J "Travelin Light" with Crystal Finish. (**Alternate Finish: Suede (provide alternate cost)).**

3. Surface Burning Characteristics ASTM E84: Class A, based on UL approved substrate and adhesive.

4. Sustainability, Indoor Air Quality: GREENGUARD Gold Certification.

5. IMO Certified for marine use.

6. Wear Resistance (Cycles) NEMA 3.13: 3500.

7. Flexural Strength ASTM D790: 20,148 psi.

8. Molding Profiles: Clear Anodized Aluminum in molding profiles as shown on drawings.

9. Adhesive: Construction Adhesive #4319 by Franklin Adhesives and Polymers or approved by panel manufacturer.

10. Joint Caulking: Color Sil by Color Rite or approved equal by panel manufacturer; 100 percent silicone based colored caulking.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's written instructions and approved submittals.

1. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation.

2. Install panels vertically with bottom edge located per the drawings and to clear top of any wall base.

3. Apply adhesive uniformly using adhesive manufacturer's recommended notched trowel to the entire back of panels completely to the edge.

4. Lay FRL panels in place, leaving approximately 3/16 inch between panel joints.

5. Install molding profiles per the drawings and per the manufacturer' written instructions.

6. Apply pressure to entire panel face with laminate type roller, removing trapped air and ensure proper adhesion between surfaces.

3.3 ADJUSTING AND CLEANING

A. Replace installation out of plumb and not aligned with adjacent panels and construction.

B. Clean panel face to remove soiling, stains, dust, and dirt using clean rags, and cleaning agents as instructed by manufacturer.

C. Leave installation clean, free of residue and debris resulting from work of this Section.

**END OF SECTION 06 42 19**

# 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. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Mineral-wool blanket insulation.
4. Loose-fill insulation.

B. Related Sections:
1. Section 07 21 19 “Foamed-in-Place Insulation” for spray polyurethane foam insulation to be installed in built-up headers, jamb studs, and as indicated on approved drawings.
2. Section 07 51 13 "Built-up Asphalt Roofing" for insulation specified as part of roofing construction.
3. Section 07 84 46 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
4. 09 24 00 "Portland Cement Plastering" for installation in wood- and metal-framed assemblies of insulation specified by referencing this Section.

### 1.3 SUBMITTALS

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

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES and listed in TER 1303-04 – Attachment of Exterior Wall Coverings Through Foam Plastic Insulating Sheathing (FBIS) to Wood or Steel Wall Framing.

### 1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

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.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except as necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Building Solutions (www.building.dow.com).
      b. Owens Corning (www.owenscorning.com).
   2. Type IV, 25 psi.
   3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or Class 2, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Atlas Roofing Corporation.
      b. Dow Building Solutions (www.building.dow.com).
      c. Rmax, Inc.

C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. CertainTeed Corporation.
   2. Guardian Building Products, Inc.
   3. Johns Manville.
   4. Knauf Insulation.
   5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## 2.3 MINERAL-WOOL BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Fibrex Insulations Inc.
   2. Owens Corning.
   3. Roxul Inc.
   4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## 2.4 LOOSE-FILL INSULATION

A. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

## 2.5 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated, but are not limited to, into the Work:
      a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
      b. Gemco; Spindle Type.
   2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- 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 square or in diameter.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated, but are not limited to, into the Work:
      a. AGM Industries, Inc.; RC150.
      b. Gemco; R-150.
   2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Ceiling plenums.
      b. Attic spaces.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated, but are not limited to, into the Work:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

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. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to 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 clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: See Section 07 21 19 “Foamed-In-Place Insulation.”

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 PROTECTION

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

3.6 INSULATION SCHEDULE

**END OF SECTION 07 21 00**

# SECTION **07 21 19** - **FOAMED-IN-PLACE 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. Closed-cell spray polyurethane foam.

B. Related Requirements:
   1. Section 07 21 00 "Thermal Insulation" for foam-plastic board insulation.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## PART 2 - PRODUCTS

### 2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM (Keynote #07 21 00.A11)

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. BASF Corporation; Spraytite.
      b. CertainTeed Corporation; CertaSpray Closed Cell Foam.
      c. Dow Chemical Company (The); STYROFOAM Spray Polyurethane Foam Insulation.
      d. Gaco Western LLC; GACOWALLFOAM 183M.
      e. Henry Company; Permax 2.0.
      f. Icynene Inc.; ICYNENE MD-C-200.
      g. Johns Manville; a Berkshire Hathaway company; JM Corbond MCS.
      h.
   2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Miscellaneous Voids: Install into cavities and voids formed by framing members where indicated on the approved drawings. Apply according to manufacturer's written instructions.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 21 19

# SECTION 07 26 50 – VAPOR EMISSION CONTROL SYSTEM

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 SECTION INCLUDES

A. Vapor Emission Control System: Provide vapor emission control system over new concrete slabs indicated to receive finished floor coverings, as follows:

1. At concrete slabs indicated to receive resilient tile flooring.
2. At new concrete slabs indicated to receive ceramic tile installed per TCA F113A.

B. Testing: Perform testing at new concrete slabs indicated to receive finished floor coverings, as specified above.

1. Test new concrete slabs for vapor emission, pH value, and relative humidity, as specified in this Section.

1.3 RELATED SECTIONS

A. Section 03 30 00 “Cast-in-Place Concrete” for concrete substrate.

B. Section 09 30 00 “Ceramic Tile

C. Section 09 65 19 “Resilient Tile Flooring.”

1.4 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual.

C. Referenced Standards:

1. ASTM C1583 - Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
2. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
3. ASTM D7234 - Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
4. ASTM E96-05 – Standard Test Methods for Water Vapor Transmission of Materials. Water Method Net perms (grains/hr/1 sq. ft.).
5. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
6. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

7. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
8. ASTM F3010-13 - Standard Practice for Two-Componenet Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.

1.5 DEFINITIONS

A. The System: Vapor emission control system specified in this Section referred to as “the System” in this Section for brevity.

1.6 SUBMITTALS

A. General: Submit under provisions of Section 01 33 00.

B. Submittal Requirements: Submit product data, test reports, certificates, and manufacturer’s standard warranty.

C. Submit independent laboratory testing on the system submitted for the following:

1. E96-05 Water Method net perm rating not to exceed 0.10.
2. ASTM D1308 14 day bath test (no effect on system at pH 14).

D. Moisture, pH, and relative humidity test results of concrete slab, certified by a qualified testing agency.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

a. Installer shall be either manufacturer’s trained personnel; or manufacturer’s factory-trained and certified installer.
b. Installer shall have a minimum of 5 years experience in the installation of specified vapor emission control system and shall have worked on a minimum of 5 installations using the same system.

2. Manufacturer Qualifications:

a. Minimum 10 years experience in manufacturing water vapor emission control systems, specifically formulated and used for reducing water vapor emissions, and alkalinity control in concrete slabs, without change of system formulation for a minimum period of 5 years at the time of application.
b. Experience in product application in similar projects requiring vapor emission control at new and existing concrete slabs.
c. Manufacturer shall provide independent laboratory test reports documenting performance of the System as follows:

1) Standard Test Method for Water Vapor Transmission of Materials, ASTM E96-05 – Perm Rating Water Method: Perm Rate results must not exceed 0.1 Perms. Net perms (grains h-1 ft2 in Hg-1)
2) Alkalinity Test, ASTM D1308: Insensitivity to alkaline environment up to pH 14 in a 14-day bath test with no effect or degradation of sample.
3) Certify acceptance and exposure to continuous topical water exposure after final cure.

3. Testing Agency Qualifications: Qualified and experienced agency to perform Moisture, pH, relative humidity (RH), and vapor emission tests, as specified in this Section.

B. Environmental Requirements: The System 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."

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the job site in manufacturer's original unopened containers, clearly labeled with the manufacturer's name and brand designation.

B. Store products in a ventilated dry area, protected from dampness, freezing, and direct sunlight. Products shall not be stored in areas with temperatures in excess of 90 degrees F or below 50 degrees F, or with humidity in excess of 80 percent.

1.9 SITE CONDITIONS

A. Concrete Curing: New concrete shall be cured for a minimum period of 28 days.

B. Enclosures and Environmental Limitations:

1. Prior to testing concrete slabs for vapor emission rates, building shall be fully enclosed, and weather-tight. Interior wet work shall be completed and nominally dry, and work above ceilings completed. Test sites shall be maintained at the same temperature and humidity expected during normal building use.
2. If a system other than the permanent HVAC source is utilized, it must provide adequate control of both temperature and humidity to recommended or specific levels for the appropriate time duration.
3. Concrete slabs shall be fully protected, with no water accumulation on the surface.
4. The concrete substrate, the installation area and materials shall be maintained at 65 degrees F to 85 degrees F and 40% to 60% relative humidity for 48 hours before and for 48 hours after completion of the installation.
5. Protect the System to prevent damage from topical water for a minimum period of 24 hours from time of applications.

1.10 WARRANTY

A. Provide manufacturer's written warranty for the System, covering system materials, testing, surface preparation, and installation. Additionally, warranty shall cover the cost of floor covering repair or replacement, as acceptable to Owner and Architect, including, but not limited to, removal work, surface preparation, underlayment, floor covering materials, primers, adhesives, and associated installation work.

1. Warranty Period: Ten years, minimum, or the life of finished floor covering, whichever comes first.
2. Replacement Cost: In the event of failure of the System during warranty period, manufacturer's warranty shall cover all costs for removal and replacement work including the System and floor covering, up to $5,000,000 per occurrence.

B. Manufacturer's warranty exclusion shall be limited to the following:

1. System failure due to topical intrusion of water due to plumbing failure, or other substances entering from the surface.

2. Seismic damage occurring after installation.
3. Moisture emission in excess of the warranted limit of the System due to water intrusion, but not limited to plumbing or flooding leaks below the slab.
4. Damage due to removal and demolition work necessitated by replacement of installed floor covering during warranty period.

C. Warranty shall not exclude cracks visible at the time of installation or "improper System installation."

PART 2- PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Vapor Emission Control System:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Vap I® 2000 by Koster American Corporation, Virginia Beach, VA; 757-425-1206, www.koesterusa.com or comparable product by one of the following:

a. Mapei; Planiseal VS.
b. Aquafin; Vaportight Coat-SG3.

B. Substitutions: Under provisions of Section 01 33 00 and shall be acceptable to the Flooring and Adhesive Manufacturer.

2.2 SYSTEM DESCRIPTION

A. System shall be a two component 100 percent solid epoxy that meets the following performance qualifications in a single coat application. System requiring more than one coat for installation is not acceptable.

B. System Performance: Installed system shall provide pH levels within the range of 8-9, as determined by pH testing.

1. Perm Rating: ASTM E96-05 (Water Method); performance of the System shall be documented by an independent testing laboratory that the System does not exceed a net 0.1 perm rating.
2. Relative Humidity Testing: ASTM F2170; System must perform in a 100% RH environment.
3. Certified acceptance of exposure to continuous topical water exposure after final curing of the System.
4. Vapor emission control system shall be applied in a single coat, and shall be a standalone system with no requirements for additional components, such as, sand broadcast for subsequent adhesion of floor covering.

C. Accessories: Concrete repair materials, underlayment, and primers used under vapor emission control system shall be as recommended by or acceptable to the System manufacturer. Underlayment used over the System shall be acceptable to vapor emission control system and floor covering and adhesives manufacturers.

2.3 MIXING

A. Use clean containers and mix components thoroughly, in accordance with manufacturer's printed instructions, to obtain a homogeneous mixture. Use a low speed motor less than 400 rpm and a two bladed Jiffy mixing blade only. Do not aerate the mixture. Mix ratios shall be measured by volume.

PART 3- EXECUTION

3.1 EXAMINATION

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

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Begin work after minimum concrete curing and drying period has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.

3.2 CONCRETE SLAB TESTING

A. Testing Schedule: Testing shall be performed by an independent testing agency prior to and after application of the System. Contractor shall coordinate and schedule testing work with the Owner’s testing agency. Provide testing surfaces as required by Owner’s testing agency.

B. Testing Environment:

1. Environmental requirements for the area to be tested shall be as required for the finished floor covering (i.e. doors, windows, roofing, etc., shall be installed and the temperature of the building controlled to a finished building atmosphere).
2. Tests are not to be executed when building interior is below 65 degrees F for 72 hours prior to and throughout the duration of the tests.

C. Pre-Installation Testing: The testing agency shall perform pre-installation testing of concrete slab by pH, calcium chloride, and relative humidity tests prior to surface preparation for application of the System. Testing shall be performed by qualified testing personnel and testing agency. Results shall be submitted to Architect for evaluation. When tests results are above the allowable thresholds specified for the intended floor covering and adhesive materials, the contractor shall proceed with installation of the System.

1. Concrete Testing: The testing agency shall perform testing for concrete deficiencies and contaminants, and to confirm that no curing compounds, sealers, coatings, un-reacted silicates, chlorides, and A.S.R. (alkali-silica reaction) are present.
2. pH Testing: The testing agency shall perform three pH tests for the first 1,000 sq. ft. and one test for each 1,000 sq. ft. thereafter per the requirements of ASTM F710.

   a. Resilient Rubber Flooring (Mondo): pH shall be between 7 and 9.

3. Vapor Emission Testing: the testing agency shall perform calcium chloride tests per ASTM F1869. Perform three calcium chloride tests for the first 1,000 sq. ft. and one test for each 1,000 sq. ft. thereafter.

   a. Resilient Rubber Flooring (Mondo): Moisture emission rates shall not exceed 5.0 lbs./1000 sq. ft./24 hours.

b. Crack Isolation Membrane: Moisture emission rates shall not exceed 3.0 lbs./1000 sq ft./24 hours.

4. Relative Humidity Testing: the testing agency shall perform tests for relative humidity in the concrete slab per ASTM F2170. Perform three tests for the first 1,000 sq. ft. and one test for each 1,000 sq. ft. thereafter.

   a. Resilient Flooring: In slab relative humidity shall not exceed 80%.
   b. Crack Isolation Membrane: In slab relative humidity shall not exceed 75%.

D. Following mechanical preparation and any necessary leveling of the concrete surface, test the tensile strength of the concrete surface according to ASTM C1583. Tensile strength of the prepared substrate surface must be at least 200 psi tested in accordance with ASTM C1583. Areas of insufficient strength shall be ground to remove the weak material and abrasively prepared again using appropriately modified methods, and retested for tensile strength.

   1. Tensile Strength Testing: the testing agency shall perform tests for tensile strength of the concrete surface per ASTM C1583. Perform three tests for the first 1,000 sq. ft. and one test for each 1,000 sq. ft. thereafter.

E. Mockup: Install the moisture mitigation system in a minimum 100 square foot mockup area, using the same methods and equipment used for the entire installation. The testing agency shall test tensile bond strength of the moisture mitigation system to the concrete substrate following ASTM D7234. The results must be equal to or greater than 200 psi.

F. Post-Installation Testing (or if System is not required to be installed due to favorable test results): After the System application is complete and before installing floor covering, the testing agency shall observe the adhesion tests. Results shall be submitted to Architect for evaluation. If the adhesion test fails, the contractor shall resolve the condition prior to installation of floor covering at no additional cost to the owner.

   1. Environmental requirements for the area to be tested shall be as required for the finished floor covering (i.e. doors, windows, roofing, etc., shall be installed and the temperature of the building controlled to a finished building atmosphere).
   2. Tests are not to be executed when building interior is below 65 degrees F and above 85 degrees F for 72 hours prior to and throughout the duration of the tests.
   3. Adhesion Test (Bond Test): the testing agency shall verify the adhesion compatibility test performed by the flooring subcontractor for flooring adhesives, coatings, and leveling compounds over completed vapor emission control system, as acceptable to Architect, Floor and Adhesive Manufacturer, and Owner.

      a. Once the subfloor preparation has been completed and is believed to be ready to receive the floor covering, the contractor shall select a small (minimum 3 foot by 3 foot) area to perform the bond test.
      b. Cut out 6 strips of material (about 2 inches wide by 1 foot long). Using the specified adhesive, glue down each strip (side by side) using the recommended notched trowel, leaving 4 to 6 inches of space between each strip. Install strips of material following the same methods and procedures that are recommended herein for the installation of the specified product.
      c. After a period of at least 24 hours (verify cure time of adhesive used), attempt to remove the flooring by pulling up one of the corners of the sample. If the bond is adequate, the material will most likely rip apart before it lets go of the substrate.
      d. If bond is adequate, proceed with installation of the flooring.

G. The testing agency shall document and submit all pH, calcium chloride, relative humidity, and adhesion test results to the Architect, Contractor, and Owner.

3.3 PREPARATION

A. Prior to installation of compliance system all walls and previously installed floor coverings shall be masked or otherwise protected from the effects of scarification and system application.

B. Clean and prepare substrates according to the System manufacturer's written recommendations to produce clean, dust-free, dry substrate for the System application.

C. Remove silicate based floor hardeners or curing compounds from concrete slabs as recommended by the System manufacturer.

D. Remove defective materials, and foreign matter, such as, dust, adhesives (do not use solvents to remove adhesives), paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, wax, form release agents, efflorescence, and laitance.

E. Cracks, control joints, and cold joints shall be prepared and treated in accordance with the System manufacturer’s requirements.

F. Clean and fill chips, voids and other surface irregularities with repair materials as recommended by the System manufacturer.

G. Acid etching is not permitted.

H. Shot blast or mechanically prepare the concrete surface to an ICRI Concrete Surface Profile (CSP) of 3 to ensure bonding of the System to concrete. Grinding is permitted only in areas inaccessible to shot blasting or for edging purposes. Shot blast a small test area and review surface profile with the finished flooring applicator. The System is not a leveling material therefore a feather finish or leveling material may be required to flatten or level the System treated concrete prior to the flooring installation. Consult with Flooring and Adhesive Manufacturers. Installation of leveling material shall be done at no additional cost to the owner.

I. Upon completion of the shot blasting and grinding, the concrete slab must be vacuumed free of all dust, dirt, and debris and allowed to dry undisturbed for 16 to 24 hours prior to the installation of the System. Do not use sweeping compounds that may contain oil.

J. System to receive resilient flooring shall conform to applicable requirements of ASTM F710.

K. Before application of the System, prepared surfaces shall be inspected by and acceptable to the System manufacturer’s technical representative.

3.4 INSTALLATION

A. General: Install vapor emission control system in accordance with manufacturer‘s written instructions as reviewed by Architect during the submittal process.

B. Application Temperature Limits: Install the System within the following temperature limitations:

1. Above 65 degrees F and below 85 degrees F; with relative humidity between 40 and 60%.

C. Installation Requirements and Procedures:

1. Application: Unless otherwise required by the System manufacturer, apply one coat of vapor emission control system at an average coverage rate of 75-150 sq. ft./gallon using a squeegee and or 3/8 inch nap roller leaving no areas untreated. Allow the System to cure for a minimum of 12 hours before installing floor covering.

a. Coverage rates shall be in accordance with the System manufacturer's recommendations and based on concrete density and porosity.

2. Environmental Condition: Install the System in environmental conditions that are representative of the environmental operating conditions of finished project.

D. Provide a leveling underlayment in conjunction with a primer when required by the Flooring Manufacturer to smooth and/or level surfaces after shot blasting and installation of the System.

E. When water based adhesives are used in the floor covering installation, use an approved underlayment system with primer, prior to the installation of the flooring system. Consult the adhesive manufacturer for their minimum recommended thickness of cementitious underlayment to absorb excess moisture in the adhesive.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Pre-installation testing, the System installation, and Post-installation testing shall be conducted in the presence of manufacturer's representative.

3.6 CLEANING

A. Clean all tools and equipment with Xylene (or similar material approved by the System manufacturer) immediately after use of the System.
B. Remove all debris resulting from the System installation from Project site.

3.7 PROTECTION

A. Protect installed vapor emission control system during curing period and until installation of the resilient floor covering from traffic, topical water, dirt, dust, and other surface contaminants.

**END OF SECTION 07 26 50**

# SECTION **07 27 26** - **FLUID-APPLIED MEMBRANE AIR-BARRIERS**

## 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 fluid-applied, vapor-permeable membrane air barriers.

### 1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
   2. Manufacturer’s representative shall be in attendance at Preinstallation Conference.

### 1.5 SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.
   1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   2. Include details of interfaces with other materials that form part of air barrier.

C. Qualification Data: For Installer.

D. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

E. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

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

B. Mockups: Build mockups to set quality standards for materials and execution.
1. Build integrated mockups of exterior wall assembly**,** 150 sq. ft. min., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
a. Include junction with roofing membrane**,** building corner condition, and foundation wall intersection.
b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. 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. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air-barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Air-barrier shall be capable of performing as a continuous vapor-permeable air-barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating

substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft, when tested according to ASTM E 283, ASTM E 783, or ASTM E 2357 utilizing a steel stud framed wall.

## 2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane or Elastomeric, modified bituminous.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Synthetic Polymer Membrane:
         1) BASF Corporation; Enershield-HP
         2) STS Coatings; Wall Guardian FW-100-A
         3) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
         4) Tremco Incorporated, an RPM company; ExoAir 230.
         5) Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
         6) Henry Company; Air-Bloc 31MR .
         7) GE; Elemax 2600.
      b. Elastomeric, Modified Bituminous Membrane:
         1) Henry Company; Air-Bloc 07.
         2) Hohmann & Barnard, Inc.; Textroflash Liquid VP.
         3) Meadows, W. R., Inc.; Air-Shield LMP.
   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Vapor Permeance: Minimum 5.5 perms; ASTM E 96.
      c. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      d. Nail Sealability: Passes ASTM D 1970

## 2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Air-barrier manufacturer’s standard.

D. Joint Reinforcing Strip: Air-barrier manufacturer's standard.

E. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

F. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

G. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

H. Transition Strip: Air-barrier manufacturer’s standard.

I. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT and O or ASTM C 920, single-component polyether, Class 25, Grade NS, Use NT and O. Comply with Section 07 92 00 "Joint Sealants."

J. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
   3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

### 3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Insure that grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings have been removed from concrete.

D. Insure that fins, ridges, mortar, and other projections have been removed and that honeycombs, aggregate pockets, holes, and other voids in concrete have been filled with substrate-patching membrane.

E. Changes in substrate plane should be addressed by manufacturer’s installation instructions and approved shop drawings.

## 3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
   1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

B. Sheathing: Fill joints with sealant and or tape according to air-barrier manufacturer's written instructions.

## 3.4 TRANSITION STRIP INSTALLATION

A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
   1. Roll firmly to enhance adhesion.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

## 3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
   1. Apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, applied in one or more equal coats.

C. Apply strip and transition strip a minimum of 1 inch onto cured air-barrier material according to air-barrier manufacturer's written instructions.

D. Do not cover air barrier until it has been reviewed by Architect, Project Inspector, and Manufacturer’s representative.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

## 3.6 FIELD QUALITY CONTROL

A. Review: Air-barrier materials, accessories, and installation are subject to review for compliance with requirements. Notify Architect when sections of work are complete so as to allow for review prior to installing insulation. The manufacturer’s representative shall be on site to review the installation along with the Architect and Project Inspector. Review may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air-barrier system has been provided.
   3. Site conditions for application temperature and dryness of substrates have been maintained.
   4. Maximum exposure time of materials to UV deterioration has not been exceeded.
   5. Surfaces have been primed, if applicable.
   6. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   7. Termination mastic has been applied on cut edges.
   8. Strips and transition strips have been firmly adhered to substrate.
   9. Compatible materials have been used.
   10. Transitions at changes in direction and structural support at gaps have been provided.

11. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

B. Air barriers will be considered defective if they do not pass review.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

3.7 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

**END OF SECTION 07 27 26**

# SECTION **07 41 13.16** - **STANDING-SEAM METAL ROOF PANELS**

## 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 standing-seam metal roof panels.

B. Related Sections:
1. Section 07 42 13.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of metal deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

### 1.4 SUBMITTALS

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

B. Shop Drawings:
1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

D. Qualification Data: For Installer.

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

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form without monetary limitation in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Special Warranty includes metal panels, flashings, fasteners, cover boards, insulation, underlayment, roofing accessories, all sheet metal-related details, termination details, and other components of the standing-seam metal roof panel system.
   2. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   3. Warranty Period: 20 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 30 years from date of Substantial Completion.

C. Special Full System Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

D. Warranty repairs shall be made in the presence of SUSD Roofers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. California Title 24, Part 6 Cool Roof Requirements (low-sloped – pitch 2:12 or less): a low-sloped cool roof must have a minimum aged solar reflectance value of 0.63 with a minimum thermal emittance value of 0.75 or a minimum solar reflectance index (SRI) of 75.

B. California Title 24, Part 6 Cool Roof Requirements (steep-sloped – pitch greater than 2:12): a steep-sloped cool roof must have a minimum aged solar reflectance value of 0.20 with a minimum thermal emittance value of 0.75 or a minimum solar reflectance index (SRI) of 16.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft.

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 90.

G. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
   1. Fire/Windstorm Classification: Class 1A-90. 2016 CBC Class A.
   2. Hail Resistance: MH.

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

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide **AEP Span: a BlueScope Steel company; Design Span HP** or comparable product by one of the following:
      a. Garland Company, Inc. (The)
      b. Tremco
      c. MBCI; a division of NCI Building Systems, L.P.
      d. Metal-Fab Manufacturing, LLC.
      e. Metal Sales Manufacturing Corporation.
   2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
      a. Nominal Thickness: 0.028 inch (24 gauge).
      b. Exterior Finish: Two-coat fluoropolymer.
      c. Color: As selected by Architect from manufacturer's full range.
   3. Clips: One-piece fixed to accommodate thermal movement with bearing plate for installation over rigid insulation.
      a. Material: UL 90 rated 18 gauge G-90 Galvanized steel, 40 ksi yield strength, 3 ½ inches long triple fastener type.
   4. Panel Coverage: 17 inches.
   5. Panel Height: 1.75 inches.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer. Underlayment shall be acceptable to the metal roofing panel manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   b. Henry Company; Blueskin PE200 HT.
   c. Kirsch Building Products, LLC; Sharkskin Ultra SA.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.

2.5 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.

B. Fasteners: #14 (1/4 inch dia. Nominal) Factory-coated steel screws with 3 inch diameter metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to steel deck and acceptable to roofing manufacturer. The screws shall be at least ¾ inch longer than the assembly being secured. Number and spacing shall be as called for in this specification section and as shown on the approved drawings.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Modified asphaltic, asbestos-free, cold-applied adhesive.

D. Wood Nailer Strips: Comply with requirements in Section 06 10 00 “Rough Carpentry."

E. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick factory primed.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Georgia-Pacific Corporation; Dens Deck DuraGuard.
      b. Temple-Inland, Inc; GreenGlass Prime.
      c. USG Corporation; Securock Glass Mat Roof Board.

F. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

2.6 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

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

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 24 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.7 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

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

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.8 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

B. Require workers 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.

3.3 INSULATION INSTALLATION

A. Comply with standing-seam metal roof panel manufacturer's written instructions, as submitted and reviewed by Architect during the submittal process, for installing roof insulation.

B. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

D. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Provide preliminary securement of insulation boards due to use of mechanically fastened roof cover boards. Install a minimum of 2 fasteners per 4 x 4 ft board or 4 fasteners per 4 x 8 ft board.
   2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

E. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten through insulation to roof deck. Tape joints if required by roofing manufacturer.
   1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
      a. Field: 16 screws per 4 foot by 8 foot panel (2 square feet per screw).
      b. Perimeter: 24 screws per 4 foot by 8 foot panel (1.33 square feet per screw).
      c. Corners: 32 screws per 4 foot by 8 foot panel (1 square foot per screw).

3.4 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.

B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.5 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Watertight Installation:
   a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
   b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of

intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 40 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction. Do not allow fasteners, cuttings, filings, or scraps to accumulate.

B. Do not apply touch-up paint to damaged paint areas that involve minor scratches.

C. Replace metal panels and flashings that have severe paint and/or substrate damage.

**END OF SECTION 07 41 13.16**

# SECTION 07 42 13.53 - METAL SOFFIT PANELS

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 metal soffit panels.

B. Related Sections:

1. Section 07 41 13.13 "Formed Metal Roof Panels" for lap-seam metal roof panels.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

D. Qualification Data: For Installer.

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

F. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.5 QUALITY ASSURANCE

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: **25** years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match material of metal roof panels.

1. Sealant: Factory applied within interlocking joint.

C. Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP **Span: a BlueScope Steel company; Vented Flush Panel** or comparable product by one of the following:

a. Garland Company, Inc. (The)
b. Tremco
c. MBCI; a division of NCI Building Systems, L.P.
d. Metal-Fab Manufacturing, LLC.
e. Metal Sales Manufacturing Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.028 inch (24 gauge).
b. Exterior Finish: Two-coat fluoropolymer.
c. Color: As selected by Architect from manufacturer's full range.

3. Panel Coverage: 12 inches.
4. Panel Height: 1.0 inch.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

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

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

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

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

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

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Do not apply touch-up paint to damaged paint areas that involve minor scratches.

D. Replace metal panels and flashings that have severe paint and/or substrate damage.

**END OF SECTION 07 42 13.53**

# SECTION 07 51 13 - BUILT-UP ASPHALT ROOFING

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 DESCRIPTION OF WORK:

A. Extent of built-up roofing (BUR) system is indicated on the drawings and by provisions of this section, and is defined to include roofing, cover board immediately under roofing, insulation immediately under cover board, composition flashing and stripping, and roofing accessories integrally related to roof installation.

B. Types of BUR required for project include:

1. California Title 24 Cool Roof Rated Asphalt/glass-fiber felt roof membrane with Cool Roof Coating.

C. Related Sections:

1. Section 05 31 00 – Steel Decking
2. Section 06 10 53 – Miscellaneous Rough Carpentry
3. Section 07 62 00 – Sheet Metal Flashing and Trim
4. Section 07 92 00 – Joint Sealers
5. Section 22 40 00 – Commercial Plumbing Fixtures and Drains
6. Section 23 05 48 – Vibration and Seismic Controls for HVAC
7. Section 23 74 00 – Rooftop Packaged Air-Conditioning Units

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to built-up roofing.

B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F, measured at the mop cart or mechanical spreader immediately before application.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed built-up roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Built-up roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by built-up roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide built-up roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

1. Corner Uplift Pressure: 36 pounds per square foot
2. Perimeter Uplift Pressure: 36 pounds per square foot
3. Field-of-Roof Uplift Pressure: 30 pounds per square foot.
4. Corner dimension: 10’-0” x 10’-0”
5. Perimeter Dimension: 10’-0”

D. FM Global Approvals Listing: Provide built-up roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a built-up roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. 2016 CBC: Class A

E. California Title 24, Part 6 Cool Roof Requirements: a low-sloped cool roof must have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75 or a minimum aged solar reflectance index (SRI) of 75.

1.5 SUBMITTALS

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

B. Shop Drawings: For built-up roofing. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and built-up terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that built-up roofing complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements, including FM listing.
2. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing base and ply sheets, membrane backer and flashing sheets, reinforcement fabric felts and mats, adhesives, mastics, coatings, and sealants.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of built-up roofing.

F. Research/Evaluation Reports: For components of built-up roofing, from the ICC-ES.

G. Maintenance Data and Training Materials: For roofing system to include in maintenance manuals and Owner’s training library.

H. Warranties: Sample of special warranties.

I. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and FM approved for built-up roofing identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by built-up roofing manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

C. Source Limitations: Obtain components of built-up roofing system from roofing system manufacturer. Other components including roof insulation, fasteners, cover boards, and substrate boards must be approved for use by roofing system manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical built-up roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing during and after installation.
9. Review roof observation and repair procedures after roofing installation.

G. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing during and after installation.
9. Review roof observation and repair procedures after roofing installation.

H. Asbestos Free Materials: No asbestos containing materials shall be used for the roofing system.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.

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

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

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

1.8 PROJECT CONDITIONS

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

B. Temporary Roofing: When adverse job conditions or weather conditions prevent permanent roofing and associated work from being installed in accordance with requirements, and it is determined by Contractor that roofing cannot be delayed because of need for job progress or protection of other work, proceed with installation of temporary roofing. Engage roofing installer to provide temporary roofing, and to remove it prior to proceeding with permanent work.

1. Record by way of Change Order the Owner’s agreement to proceed with temporary roofing, along with additional costs and other changes (if any) to Contract Documents.

1.9 WARRANTY

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

1. Special warranty includes built-up roofing membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarders, roofing accessories, all sheet metal-related details, termination details, walkway products, and other components of built-up roofing for the following warranty period:
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including labor and all components of built-up roofing such as built-up roofing membrane, base flashing, roof insulation, fasteners, cover boards, vapor retarders, roofing accessories, all sheet metal-related details, termination details, walkway products, and other components of built-up roofing for the following warranty period:

1. Warranty Period: 36 months from date of Substantial Completion.

C. Warranty repairs shall be made in the presence of SUSD Roofers.

2. PRODUCTS

2.1 BUILT-UP ROOFING MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Tremco, Incorporated
2. The Garland Company, Incorporated
3. Architect and District approved equal.

2.2 TEMPORARY ROOFING

A. Temporary Roofing Member: 2 plies perforated No. 15 asphalt-saturated organic felt complying with ASTM D 226, Type I, set in and glaze-coated with hot moppings of ASTM D 312, Type III asphalt.

2.3 BASE-SHEET MATERIALS

A. **Base Sheet:** ASTM D 4601, Type II, nonperforated, asphalt-coated, SBS-modified fiberglass/fiberglass/ polyester reinforced sheet dusted with fine mineral surfacing on both sides.

1. Basis of design product: **Tremco, BURmastic Composite Ply HT**.
2. Thickness, minimum, ASTM D 146: 0.055 inch (1.4mm).

2.4 ROOFING MEMBRANE PLIES

A. Ply Sheet: ASTM D 2178, Type VI, asphalt-impregnated, glass-fiber felt.

2.5 CAP SHEET MATERIALS

A. **Roofing Membrane Cap Sheet:** ASTM D6163, Grade G, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced.

1. Basis of design product: **Tremco, POWERply Standard FR**.
2. Exterior Fire-Test Exposure, ASTM E 108: Class A.
3. Thickness, minimum, ASTM D 5147: 0.120 inch (3 mm).
4. Granule Color: White.

2.6 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 2178, Type VI, asphalt-impregnated, glass-fiber felt.

B. Granule-Surfaced Flashing Sheet: ASTM D 6163, Grade G, Type I or II, glass-fiber-reinforced, SBS-modified asphalt sheet; smooth surfaced, dusted with fine parting agent on both sides; suitable for application method specified, and as follows:

1. Granule Color: White

**C. Elastomeric Single Ply Flashing Sheet**: ASTM D5019, Type I, Grade II, CSPE sheet.

1. Basis of design product: **Tremco, Hypalon Elastomeric Sheeting**.
2. Thickness, minimum, ASTM D 751: 0.040 inch (1.0 mm).
3. Color: **White.**
4. To be used when the base flashings exceed 8 inches in height or where indicated on the drawings.

D. Lead Flashing: 4 lb. sheet of common desilverized pig lead.

2.7 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D 312, Type IV as recommended by built-up roofing manufacturer for application.

B. Asphalt Primer: ASTM D41.

2.8 AUXILIARY BUILT-UP ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.

B. Single Ply Elastomeric Sheeting Adhesive: Roofing manufacturer's one part elastomer specially formulated adhesive for use with single ply flashing material specified.

C. Cold-Applied Flashing Adhesive: Roofing manufacturer’s standard asphalt based, one or two part asbestos free, cold applied adhesive specially formulated for compatibility and use with built-up and CSPE base flashings.

D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing manufacturer for application.

E. Mastic Sealant: Modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.

F. Parapet Wall Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate, 5/8 inch thick.

1. Products: Subject to compliance with requirements, provide the following:

a. Georgia-Pacific Corporation; Dens Deck Prime.

G. Screws for Fastening Parapet Wall Cover Board to Cold-Formed Metal Framing: Steel drill screws, in length necessary to achieve penetration through metal stud flange of no fewer than 3 exposed threads or 3/8 inch (whichever is greater), with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

a. Size: #6-20 x 1 ¼ inch (minimum)
b. Head Type: #2 Phillips drive, bugle-head.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.

I. Metal Flashing Sheet: Metal flashing sheet is specified in Section 07 62 00 – Flashing and Sheet Metal.

J. Wood Members, Units: Comply with requirements of other sections of these specifications for nailers, walkway units and other wood members indicated as roofing system work. Provide redwood or wood pressure treated with water-borne preservatives for aboveground use (AWPB LP-2).

K. Miscellaneous Accessories: Provide miscellaneous accessories recommended by built-up roofing manufacturer.

2.9 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FMG Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated. The minimum thickness shall be 3”.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.10 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.

B. Fasteners: #14 (1/4 inch dia. Nominal) Factory-coated steel screws with 3 inch diameter metal or plastic plates meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to steel deck and acceptable to roofing manufacturer. The screws shall be at least ¾ inch longer than the assembly being secured. Number and spacing shall be as called for in this specification section and as shown on the approved drawings.

C. Hot Asphalt Insulation Adhesive: Roofing Asphalt, ASTM D 312, Type III as recommended by built-up roofing manufacturer for application.

D. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

E. Wood Nailer Strips: Comply with requirements in Section 06 10 00 - Rough Carpentry.

F. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

G. Cover Board: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board, 1/2 inch thick.

1. Products: Subject to compliance with requirements, provide the following:

a. Blue Ridge Fiberboard; Stuctodeck HD with Primed Red Coating
b. Architect and District approved equal.

H. Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.

1. Products: Subject to compliance with requirements, provide the following:

a. Georgia-Pacific Corporation; Dens Deck.

I. Cover Board: ASTM C 1278, fiber reinforced, moisture-resistant gypsum blend substrate, 1/2 inch thick.

1. Products: Subject to compliance with requirements, provide the following:

a. USG; Securock.

J. Substrate Joint Tape: 6- or 8-inch wide, coated, glass fiber.

2.11 COATING MATERIALS

A. Roof Coating: Acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces:

1. Products: Subject to compliance with requirements, provide the following:

a. Tremco, Inc.; Polarcote FR
b. The Garland Company, Inc.; Pyramic
c. Architect and District approved equal.

2. Initial Percent Elongation (Break): Not less than 60 percent at 0 deg F and 200 percent at 73 deg F when tested according to ASTM D 2370.
3. Initial Tensile Strength (Maximum Stress): Not less than 100 psi at 73 deg F and 200 psi at 0 deg F when tested according to ASTM D 2370.

4. Final Percent Elongation (Break) after Accelerated Weathering 1000 hours: Not less than 40 percent at 0 def F and 100 percent at 73 def F when tested according to ASTM D 2370.
5. Permeance: Not more than 50 perms when measured according to ASTM D 1653.
6. Accelerated Weathering 1000 hours: No cracking or checking when tested according to ASTM D 4798.
7. Color: White

2.12 WALKWAYS

A. Walkway Pads: Mineral-granule-surfaced, reinforced asphaltic composition, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to roofing manufacturer, 1/2 inch thick, minimum.

1. Pad Size: 3’ x 5’ at all HVAC unit access panel service areas and at roof hatches and roof access ladder locations. 2’ x 4’ between HVAC units and roof hatches and roof access ladder locations.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 – Metal Roof Decking.
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 PARAPET WALL COVER BOARD INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions as submitted to and approved by Architect.

1. Fasten cover board to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.

3. Install boards with a 1/4-inch gap where they abut materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of cover board, but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.4 INSULATION INSTALLATION

A. Comply with built-up roofing manufacturer's written instructions, as submitted and reviewed by Architect during the submittal process, for installing roof insulation.

B. Install one lapped base sheet course and mechanically fasten to substrate according to built-up roofing manufacturer's written instructions and as called for in these specifications and on the drawings.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.

a. Field: 16 screws per 4 foot by 8 foot panel (2 square feet per screw).
b. Perimeter: 24 screws per 4 foot by 8 foot panel (1.33 square feet per screw).
c. Corners: 32 screws per 4 foot by 8 foot panel (1 square foot per screw).

2. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing manufacturer.

1. Apply hot roofing asphalt to underside and immediately bond cover board to substrate.

3.5 BUILT-UP ROOFING INSTALLATION, GENERAL

A. Install roofing membrane according to roofing manufacturer's written instructions as reviewed by Architect during the submittal process and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:

1. Deck Type: I (insulated).
2. Base Sheet: 1.
3. Number of Ply Sheets: 2.
4. Cap Sheet: 1.
5. Surfacing Type: S (coating). Coating shall comply with requirements of California Title 24, Part 6 for Cool Roof Application.

B. Start installation of built-up roofing in presence of manufacturer's technical personnel.

C. Cooperate with testing agencies engaged or required to perform services for installing roofing.

D. Coordinate installation of roofing so insulation and other components of built-up roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed built-up roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Asphalt Heating: Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Do not heat roofing asphalt within 25 deg F of flash point. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

F. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

3.6 ROOFING MEMBRANE INSTALLATION

A. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:

1. Adhere to substrate in a solid mopping of hot roofing asphalt as directed by roofing manufacturer's written instructions as submitted to and reviewed by Architect.

B. Install two ply sheets starting at low point of roofing. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.

1. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

C. Cap Sheet: Install lapped granulated cap sheet starting at low point of roofing system. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.

1. Embed cap sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer.

3.7 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to built-up roofing manufacturer's written instructions and as follows:

1. Backer Sheet Application: Adhere backer sheet to substrate in cold-applied adhesive.

2. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive or sheet adhesive at rate required by roofing manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches above built-up roofing and 6 inches onto field of built-up roofing unless otherwise noted or shown in the details on the approved drawings. In most cases flashing shall extend up and over the top of the parapet wall under the parapet cap flashing and shall tie into the air barrier system specified in Section 07 27 26 “Fluid Applied Membrane Air-Barriers.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Roof Drains: Set 36-by-30-inch 4 lb. lead flashing (at each drain) in bed of asphalt roofing cement on completed built-up roofing. Clean lead flashing before priming. Prime lead flashing with asphalt primer by roll or brush application (spray application not allowed). Cover lead flashing with built-up roofing cap-sheet stripping and extend a minimum of 6 inches beyond edge of lead flashing onto field of built-up roofing. Clamp built-up roofing, metal flashing, and stripping into roof-drain clamping ring.

1. Install stripping according to roofing manufacturer's written instructions.

3.8 COATING INSTALLATION

A. Apply coating to roofing membrane and base flashings according to manufacturer's written instruction, by spray, roller, or other suitable application method.

1. Prior to application of cool roof coating, contractor shall inspect roof with manufacturer's technical representative, the owner's roofing department, the architect, and the inspector of record and shall repair any deficiencies.

2. Roofing manufacturer's acrylic coating primer shall be applied to all prepared surfaces to be coated at a rate of 1 gallon per 200-250 square feet.

3. Apply coating in 2 layers at a rate of 1.5 gallons per 100 square feet for each layer. (3 gallons/SQ total.)

4. Back rolling the application of the two coats is required.

3.9 WALKWAY INSTALLATION

A. Install walkway pads according to roof plan. Spot adhere to completed roofing membrane (after coating installation) with adhesive as approved by roofing manufacturer as reviewed and approved by Architect during the submittal process.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Technical Representative: Contractor will engage a qualified manufacturer's technical representative acceptable to Owner for a minimum of 3 days on site to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection; Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.

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

3.11 PROTECTING AND CLEANING

A. Protect built-up roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.12 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: Stockton Unified School District.
2. Address: 701 N. Madison Street, Stockton, CA 95212
3. Building Name/Type: Building K and Building L at Kennedy Elementary School
4. Address: 630 Ponce De Leon Ave, Stockton, CA 95210
5. Area of Work: <**Insert information**>.
6. Acceptance Date: <**Insert date**>.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: <**Insert date**>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

   a. lightning;

   b. peak gust wind speed exceeding 75 mph;

   c. fire;

   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

   e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;

   f. vapor condensation on bottom of roofing; and

   g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty and may be held liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with

penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. General Contractor or roofing installer shall contact and meet with SUSD roofers on site. Repairs shall be made in the presence of the SUSD Roofers.

8. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.

1. Authorized Signature: <**Insert signature**>.

2. Name: <**Insert name**>.

3. Title: <**Insert title**>.

**END OF SECTION 07 51 13**

# SECTION 07 56 00.13 – FLUID-APPLIED MEMBRANE ROOFING, INSULATED

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 cold fluid-applied hybrid roofing systems over metal framing and substrate boards, consisting of the following:

1. Tapered Roof insulation and Cover Board.

2. Base Membrane Sheet.

3. Application of roof membrane and flashings consisting of multiple coats of fluid-applied, fabric-reinforced, polyurethane coating.

4. Section 06 10 00 – Rough Carpentry.

5. Section 07 62 00 – Sheet Metal Flashing and Trim.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. FM Approvals Listing: Provide fluid-applied roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a fluid-applied hybrid roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-75

2. RoofNav Assembly: #314323-314305-0

D. SPRI Wind Design Standard: Manufacture and install roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: 44 lbs/sq. ft. horizontal and 76 lbs/sq. ft. vertical.

E. Flashings: Comply with requirements of Section 07 62 00 “Sheet Metal Flashing and Trim.” Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:

1. FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings.

2. FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components.

3. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.

4. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.

F. Exterior Fire-Test Exposure: 2013 CBC and ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

1.5 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Provide roof plan showing orientation and types of roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened components.

1. Base flashings and terminations.
   a. Indicate details meet requirements of NRCA and FMG required by this Section.

2. Tapered insulation, including slopes.

3. Crickets, saddles, and tapered edge strips, including slopes.

4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Contractor's Product Certificate: Submit notarized certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers’ names, with statement indicating that products to be provided meet the requirements of the Contract Documents.

1. Indicate Factory Mutual Global assembly compliance.

2. Indicate UL listing.

D. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.

1. Letter written for this Project indicating manufacturer approval of Installer to apply specified products and provide specified warranty.

2. Certificate indicating Installer is qualified in Project jurisdiction to perform asbestos abatement.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

F. Warranties: Unexecuted sample copies of special warranties.

G. Inspection Reports: Daily reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions required and carried out.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

B. Warranties: Executed copies of approved warranty forms.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years experience installing products comparable to those specified, able to communicate verbally with Contractor, Architect, and employees, and the following:

1. Qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with UL listed, FM Global approved products, with minimum five years experience in manufacture of specified products in successful use in similar applications.

1. Approval of Other Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
   a. Product data, including certified independent test data indicating compliance with requirements.
   b. Samples of each component.
   c. Sample submittal from similar project.
   d. Project references: Minimum of five installations of specified products not less than five years old, with Owner and Architect contact information.
   e. Sample warranty.

C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer’s compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute, retained by the Contractor or the Manufacturer and approved by the Manufacturer.

D. Roofing Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system.

1. Meet with Owner; roofing materials manufacturer's representative; roofing Installer including project manager and foreman; and installers whose work interfaces with or affects roofing.

2. Review methods and procedures related to preparation, including membrane roofing system manufacturer's written instructions.

3. Review roof drainage during each stage of roofing and review roof drain plugging and plug removal procedures.

4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

5. Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect re-coating.

6. Review governing regulations and requirements for insurance and certificates if applicable.

7. Review existing conditions that may require notification of Owner before proceeding.

E. Asbestos Free Materials: No asbestos containing materials shall be used for the roofing system.

1.8 PROJECT CONDITIONS

A. Protect building, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from roofing operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

C. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

1. Store all materials prior to application at temperatures between 60 and 90 deg. F.

2. Apply coatings within range of ambient and substrate temperatures recommended by manufacturer. Do not apply materials when air temperature is below 50 or above 110 deg. F.

3. Do not apply roofing in snow, rain, fog, or mist.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.

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

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

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

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of **fluid applied membrane** roofing that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membranes, coatings, base flashings, roof insulation, fasteners, cover boards, vapor retarders, roofing accessories, all sheet metal-related details, termination details, and other components of built-up roofing for the following warranty period:

2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including labor and all components of **fluid applied membrane** roofing such as membrane**s, coatings**, base flashing, roof insulation, fasteners, cover boards, vapor retarders, roofing accessories, all sheet metal-related details, termination details, and other components of built-up roofing for the following warranty period:

1. Warranty Period: 36 months from date of Substantial Completion.

C. Warranty repairs shall be made in the presence of SUSD Roofers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer/Product: The roof system specified in this Section is based upon products of Tremco, Inc., Beachwood, OH, (800) 562-2728, www.tremcoroofing.com that are named in other Part 2 articles. Subject to compliance with requirements, provide the named product or an Architect and District approved Equal.

B. Source Limitations: Obtain roofing membrane materials and roofing membrane flashings from single manufacturer. Other components including roof insulation, fasteners, cover boards, and substrate boards must be approved for use by roofing system manufacturer.

2.2 MATERIALS

A. General: Roofing materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system.

B. Temporary Roofing Materials: Selection of materials and design of temporary roofing is responsibility of Contractor.

C. General: Provide adhesive and sealant materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Plastic Foam Adhesives: 50 g/L.
   b. Gypsum Board and Panel Adhesives: 50 g/L.
   c. Multipurpose Construction Adhesives: 70 g/L.

d. Other Adhesives: 250 g/L.
e. Sealant Primers for Porous Substrates: 775 g/L.

2.3 BASE SHEET MATERIALS

A. Basis-of-Design Base Sheet: **Tremco, BURmastic Composite Ply Premium: Nonperforated, a**sphalt-coated, polyester/fiberglass/polyester reinforced sheet dusted with fine mineral surfacing on both sides which meets the requirements of ASTM D 4601, Type II, and the following properties:

B. Base Sheet Adhesive: One-part, solvent-free, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:

1. Basis of design product: **Tremco, SF BURmastic**.

2. Adhesive: Asbestos Content, EPA 600 R-93/116: None.

3. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: 40 g/L.

2.4 FLUID-APPLIED ROOFING MEMBRANE

A. Polyurethane Elastomeric Fluid-Applied System: ASTM D 7311, elastomeric, two-coat single-component moisture triggered polyurethane fluid-applied roofing formulated for application to existing built-up roofing, with the following minimum physical properties:

1. Aliphatic Urethane Base Coat:
   a. Basis of Design Product: Tremco, AlphaGuard MT Base Coat.
   b. Asbestos Content, EPA/600/R-93/116: None.
   c. Volatile Organic Compounds (VOC), ASTM D 3960: Not greater than 40 g/L.
   d. Percent solids (by weight), ASTM D 1644: Not less than 85 percent.

2. Aliphatic Urethane Top Coat: UV-stabilized, chemical-resistant top coat:
   a. Basis of Design Product: Tremco, AlphaGuard MT Top Coat.
   b. Asbestos Content, EPA/600/R-93/116: None.
   c. Volatile Organic Compounds (VOC), ASTM D 3960: Not greater than 45 g/L.
   d. Color: As selected by Architect from manufacturer's standard colors.

B. Fiberglass Reinforcement: Medium to fine fiber, rapid wetting chopped strand glass mat for fluid-applied membrane and flashing.

1. Basis of Design Product: Tremco, AlphaGuard Glass Mat.

2.5 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with existing roofing system and fluid-applied roofing system.

B. Metal Surface Primer: Single-component, water based primer to promote adhesion of base coat to metal surfaces.

1. Basis of Design Product: Tremco, AlphaGuard M-Prime.

C. Asphaltic Surfaces Primer: Single-component, multi-substrate primer to promote adhesion of base coat to surfaces recommended by manufacturer.

1. Basis of Design Product: Tremco, AlphaGuard Re-Prime and AlphaGuard WB Primer.

D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing manufacturer for application.

E. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.

F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 SUBSTRATE BOARDS / INSULATION

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Polyisocyanurate Board Thermal Roof Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces, “or approved equal”.

1. Manufacturers:
   a. Tremco, Inc.
   b. Atlas Roofing Corporation.
   c. Celotex Corporation.
   d. GAF Materials Corporation.
   e. Hunter Panels, LLC.
   f. Koppers Industries.
   g. RMAX.

C. Tapered Insulation: Where designated, provide factory-tapered polyisocyanurate insulation boards fabricated to slope of 1/4” in 12” (minimum) to drain, unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated and as directed by Owner for sloping to drain. Fabricate to slopes indicated.

E. Fasteners: Where applicable and specified, #14 (1/4 inch dia. Nominal) factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer. The screws shall be at least ¾ inch longer than the assembly being secured. Number and spacing shall be as called for in this specification section and as shown on the approved drawings.

F. Insulation Adhesive: **Equal to Tremco Low Rise Foam Insulation Adhesive:** Solvent-free, low rise, multi-component urethane adhesive formulated to adhere roof insulation to substrate, with the following minimum physical properties:

1. Asbestos Content, EPA 600/R13/116: None.

2. Elongation at 77 deg. F, minimum, ASTM D 412: 1200 percent.

3. T-Peel Strength at 77 deg. F, minimum: ASTM D 1876: 15 lbf.

4. Adhesion Strength in Shear at 77 deg. F, minimum, ASTM D 816: 80 psi.

G. Low-VOC, water-based adhesive substrate primer: Equal to **Tremco, Tremprime WB.**

H. Insulation Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate board, 1/2" thick

1. Product: Subject to compliance with requirements, provide **Dens-Deck Prime** by Georgia-Pacific Corporation, "or approved equal".

I. Cant Strip: ASTM C 208, Type II, Grade 1, cellulosic-wood fiber.

J. Wood Nailers, Cant Strips: Comply with requirements in Section 06 10 00 "Rough Carpentry."

K. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

5. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

3.3 FLUID-APPLIED MEMBRANE ROOFING INSTALLATION, GENERAL

A. Install roofing membrane according to roofing manufacturer's written instructions.

1. Commence installation of roofing in presence of manufacturer's technical personnel.

B. Coordinate installation of roofing so insulation and other components of roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Substrate-Joint Penetrations: Prevent fluid-applied materials and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

3.4 INSULATION INSTALLATION

A. Comply with roofing manufacturer's written instructions for installing roof insulation.

B. Install tapered insulation under area of roofing to conform to slopes indicated.

C. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding **1/4 inch** with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is **2.7 inches** or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of **6 inches** in each direction.

1. Install tapered insulation at thickness of minimum 3/4 inches.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

G. Adhered Insulation (where called for on approved plans): Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

2. Set each additional layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

H. Mechanically Fastened and Adhered Insulation (where called for on approved plans): Install first layer of insulation to steel framing using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation to resist uplift pressure.
   a. 32 screws per 4 foot by 8 foot panel (1 square foot per screw).

2. Set each additional layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches** in each direction. Loosely butt cover boards together.

1. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover in place.

3.5 BASE SHEET INSTALLATION

A. Install base sheet starting at low point of roofing. Align base sheet without stretching. Shingle side laps of base a minimum of 4 inches. Shingle in direction to shed water. Extend base sheets over edges and terminate above cants.

1. Embed base sheet in cold-applied membrane adhesive applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

B. Extend base flashing up walls or parapets a minimum of **8 inches** above roofing and **6 inches** onto field of roofing.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing with specified sealant.

2. Seal top termination of base flashing with a metal termination bar.

D. Install stripping according to roofing manufacturer's written instructions where metal flanges and edgings are set on roofing.

1. Flashing Sheet Stripping: Install flashing sheet stripping in specified cold adhesive and extend onto roofing membrane.

E. Roof Drains: Install base sheet in cold adhesive around drain bowl. Base sheet must be installed so that it will be under compression from the clamping ring. Install base coat, fiberglass reinforcement, and top coat over base sheet. Install drain clamping ring and strainer.

3.6 FLUID-APPLIED MEMBRANE APPLICATION

A. Base Coat: Apply coating base coat to asphaltic base sheet surfaces in accordance with manufacturer's written instructions. Back roll to achieve minimum wet mil coating thickness of 48 mils unless otherwise recommended by manufacturer; verify thickness of base coat as work progresses.

1. Apply base coat on prepared and primed surfaces and spread coating evenly.

2. Embed fiberglass reinforcement into wet base coat. Lap adjacent flashing pieces of fiberglass minimum 3 inches along edges and 6 inches at end laps.

3. Roll surface of fiberglass reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

4. Allow base coat to cure prior to application of top coat.

5. Following curing of base coat and prior to application of top coat, sand raised or exposed edges of fiberglass reinforcement.

B. Fluid-Applied Flashing Application: Complete base coat and fiberglass reinforcement at parapets, curbs, penetrations, and drains prior to application of field of fluid-applied membrane.

1. Extend coating minimum of 8 inches up vertical surfaces and 4 inches onto horizontal surfaces.

2. Roof Drains: Install base coat onto surrounding membrane surface and metal drain bowl flange. Install target piece of fiberglass reinforcement immediately into wet base coat and roll to fully

embed and saturate fabric. Reinstall clamping ring and strainer following application of top coat. Replace broken drain ring clamping bolts.

C. Top Coat: Apply top coat uniformly in a complete installation to flashings and field of roof.

1. Prime base coat prior to application of top coat if top coat is not applied within 72 hours of the base coat application, using manufacturer's recommended primer.

2. Apply top coat to flashings extending coating up vertical surfaces and out onto horizontal surfaces 4 inches. Install top coat over field base coat and spread coating evenly.

3. Back roll to achieve wet mil thickness of 32 mils unless otherwise recommended by manufacturer.

4. Avoid foot traffic on new fluid-applied membrane for a minimum of 24 hours.

3.7 FIELD QUALITY CONTROL

A. Roof Inspection: Contractor shall engage roofing system manufacturer's technical personnel to inspect roofing installation , and submit report to the Architect. Notify Architect or Owner 48 hours in advance of dates and times of inspections. Inspect work as follows:

1. Upon completion of preparation of first component of work, prior to application of re-coating materials.

2. Following application of re-coating to flashings and application of base coat to field of roof.

3. Upon completion of re-coating but prior to re-installation of other roofing components.

B. Repair fluid-applied membrane where test inspections indicate that they do not comply with specified requirements.

C. Arrange for additional inspections, at Contractor's expense, to verify compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

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

B. Correct deficiencies in or remove coating that does not comply with requirements, repair substrates, and reapply coating.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

D. END OF SECTION **07 56 00.13**

# SECTION **07 62 00** - **SHEET METAL FLASHING AND TRIM**

## 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. Manufactured Products:
      a. Manufactured reglets and counterflashing.
   2. Formed Products:
      a. Formed roof drainage sheet metal fabrications.
      b. Formed low-slope roof sheet metal fabrications.
      c. Formed wall sheet metal fabrications.
      d. Formed equipment support flashing.

B. Related Sections:
   1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 41 13.16 "Standing-Seam Metal Roof Panels" for sheet metal flashing and trim integral with metal roof panels.
   3. Section 07 42 13.53 " Metal Soffit Panels" for sheet metal flashing and trim integral with metal soffit panels.
   4. Section 07 71 00 "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
   5. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
   1. Wind Zone Class 1-90: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 1.4 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
   1. Identification of material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   4. Details of termination points and assemblies, including fixed points.
   5. Details of special conditions.
   6. Details of connections to adjoining work.
   7. Layout drawings at a scale of not less than 1/4 inches per 12 inches.
   8. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Qualification Data: For qualified fabricator.

## 1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Preinstallation Conference: Conduct conference in conjunction with Preinstallation Roofing Conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
   5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

## PART 2 - PRODUCTS

### 2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
   2. Surface: Smooth, flat and mill phosphatized for field painting

### 2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

### 2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.

C. Solder:
   1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

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

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions with interlocking counterflashing on exterior face, of same metal as reglet.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Fry Reglet Corporation or comparable product by one of the following:
      a. Cheney Flashing Company.
      b. Heckmann Building Products Inc.
      c. Hickman, W. P. Company.
      d. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
      e. Keystone Flashing Company, Inc.
      f. National Sheet Metal Systems, Inc.
      g. Sandell Manufacturing Company, Inc.
   2. Material: Galvanized steel, 0.028 inch (24 gauge) thick.
   3. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
   4. Accessories:
      a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
      b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
   5. Finish: Mill phosphatized for field painting.

## 2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

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

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

## 2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Gutters (**not associated with standing seam metal roof system**): Fabricate to cross section indicated on approved drawings, complete with end pieces, outlet tubes, and other accessories as required. Fabricate gutter accessories from same metal as gutters.
1. Accessories: Wire ball downspout strainer.
2. Gutters with Girth 21 to 25 Inches: Fabricate from the following materials:
   a. Galvanized Steel: 0.034 inch (22 gauge) thick.

B. Downspouts: Fabricate round downspouts complete with mitered elbows. Furnish with metal hangers and anchors as indicated on approved drawings.
1. Fabricated Hanger Style: As indicated on approved drawings.
2. Fabricate from the following materials:
   a. Galvanized Steel Standard Pipe: Size as indicated on approved drawings.

C. Splash Pans: Fabricate from the following materials:
1. Zinc-Tin Alloy-Coated Stainless Steel: 0.025 inch (24 gauge) thick.

## 2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.
1. Coping Profile: As indicated on drawings.

2. Joint Style: Flat lock seam.
3. Fabricate from the following materials:
   a. Galvanized Steel: 0.028 inch (24 gauge) thick.

B. Base Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (24 gauge) thick.

C. Counterflashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (24 gauge) thick.

D. Flashing Receivers: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (24 gauge) thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (24 gauge) thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (24 gauge) thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch (24 gauge) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
   4. Install sealant tape where indicated.
   5. Torch cutting of sheet metal flashing and trim is not permitted.
   6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
   1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 3/4 inch for wood screws and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
   1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

## 3.4 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters as indicated on approved drawings. Provide end closures and seal watertight with sealant. Slope to downspouts.

C. Downspouts:
   1. Provide hangers with fasteners designed to hold downspouts securely to walls as indicated on approved drawings.
   2. Provide elbows at base of downspout to direct water away from building and into downspout catch basin.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with roofing membrane.

## 3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone class and as indicated.
   1. Interlock bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

## 3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches] beyond wall openings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07 62 00**

# SECTION **07 71 29** - **MANUFACTURED ROOF EXPANSION JOINTS**

## 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. Aluminum roof expansion joints.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
   2. Section 05 31 00 "Steel Decking" for covered walk roofing system.
   3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.
   4. Section 07 72 00 "Roof Accessories" for manufactured and prefabricated metal roof curbs.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof expansion joints.
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
   3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches in size.

D. Qualification Data: For Installer.

E. Sample Warranties: For special warranties.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ALUMINUM ROOF EXPANSION JOINTS

A. Aluminum Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
      b. Balco, Inc.
      c. Construction Specialties, Inc.
      d. InPro Corporation.
      e. MM Systems Corporation.
      f. Nystrom Building Products.
   2. Joint Movement Capability:
      a. Nominal Joint Width: 4 inches.
      b. Minimum Joint Width: 2 inches.
      c. Maximum Joint Width: 6 inches.
      d. Type of Movement: Seismic.
   3. Frame Members: Extruded aluminum configured with integral 5-1/2-inch tall aluminum curb as indicated; with exposed finish matching cover.
   4. Cover: Formed aluminum; thickness as recommended by manufacturer.
      a. Aluminum Finish: Mill.
   5. Centering Devices: Centering bars.
   6. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the cover. Secondary seal to be sloped to direct collected moisture to drain to the exterior-wall expansion joint cover.

2.3 MATERIALS

A. Aluminum: ASTM B 209 for sheet and plate, ASTM B 221 for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
   2. Mill Finish: As manufactured.

B. EPDM Membrane: ASTM D 4637, Type standard with manufacturer for application.

C. Neoprene Membrane: Neoprene sheet recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil; and as standard with roof-expansion-joint manufacturer for application.

D. PVC Membrane: ASTM D 4434, Type standard with manufacturer for application.

E. Silicone Extrusions: ASTM D 2000, UV stabilized, and that does not propagate flame.

F. Adhesives: As recommended by roof-expansion-joint manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

H. Mineral-Fiber Blanket: ASTM C 665.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine roof-joint openings, inside surfaces of parapets, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.

1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
2. Install roof expansion joints true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
3. Provide for linear thermal expansion of roof expansion joint materials.
4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
5. Provide uniform, neat seams.
6. Install roof expansion joints to fit substrates and to result in watertight performance.
7. Torch cutting of roof expansion joints is not permitted.
8. Do not use graphite pencils to mark aluminum surfaces.

B. Directional Changes and Other Expansion-Control Joint Systems: Coordinate installation of roof expansion joints with other expansion-control joint systems to result in watertight performance. Install factory-fabricated units at directional changes and at transitions between roof expansion joints and exterior expansion-control joint systems specified in Section 07 95 00 "Expansion Control" to provide continuous, uninterrupted, and watertight joints.

C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.
   1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

3.3 PROTECTION

A. Protect roof expansion joints from foot traffic, displacement, or other damage.

B. Remove and replace roof expansion joints and components that become damaged by moisture or otherwise.

**END OF SECTION 07 71 29**

# SECTION **07 72 00** - **ROOF 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. Equipment supports.

B. Related Sections:
   1. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, and miscellaneous sheet metal trim and accessories.
   2. Section 07 71 29 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint covers.

### 1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

### 1.4 SUBMITTALS

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

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Required clearances.

D. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation and mill phosphatized for field painting where indicated.
   1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.

D. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

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

G. Underlayment:
   1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

H. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

I. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

J. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

K. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

L. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.3 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints and integrally formed deck-mounting flange at perimeter bottom.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Custom Solution Roof and Metal Products.
      b. Pate Company (The).
      c. Roof Products, Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (14 gauge) thick.
   1. Finish: Mill phosphatized.

D. Construction:
   1. Factory-installed continuous wood nailers as indicated on drawings at tops of equipment supports.
   2. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
   3. Fabricate equipment supports to minimum height of 24 inches (8 inches minimum above roofing surface).
   4. Sloping Roofs: Where roof slope, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

## 2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

D. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 00 " Painting and Finishing."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

**END OF SECTION 07 72 00**

# SECTION **07 84 13** - **PENETRATION FIRESTOPPING**

## 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. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.

B. Related Sections:
   1. Section 07 84 46 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For sealants, sealant primers, and caulks, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of sealant, sealant primer, or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Qualification Data: For qualified Installer.

E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:
         1) UL in its "Fire Resistance Directory."

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify DSA Project Inspector at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hilti, Inc.
   2. RectorSeal Corporation.
   3. Specified Technologies Inc.
   4. 3M Fire Protection Products.
   5. Tremco, Inc.; Tremco Fire Protection Systems Group.
   6. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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."

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.

d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

### 3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

### 3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes in contrasting color.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

## 3.5 FIELD QUALITY CONTROL

A. The DSA Project Inspector will observe the installation and perform tests and inspections as required per ASTM E 2174 “Standard Practice for On-Site Inspection of Installed Fire Stops.”

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

## 3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

## 3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Firestopping for Metallic Pipes, Conduit, or Tubing:
   1. UL-Classified Systems: F-A-1001-1999 (floors) and W-L-1001-1999 (walls).
   2. F-Rating: 1 hour minimum.

3. Type of Fill Materials: As required to achieve rating.

C. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
1. UL-Classified Systems: F-A-2001-2999 (floors) and W-L-2001-2999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.

D. Firestopping for Electrical Cables:
1. UL-Classified Systems: F-A-3001-3999 (floors) and W-L-3001-3999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.

E. Firestopping for Cable Trays with Electric Cables:
1. UL-Classified Systems: W-L-4001-4999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.

F. Firestopping for Insulated Pipes:
1. UL-Classified Systems: F-A-5001-5999 (floors) and W-L-5001-5999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.

G. Firestopping for Miscellaneous Electrical Penetrants:
1. UL-Classified Systems: F-A-6001-6999 (floors) and W-L-6001-6999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.

H. Firestopping for Miscellaneous Mechanical Penetrants:
1. UL-Classified Systems: F-A-7001-7999 (floors) and W-L-7001-7999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.

I. Firestopping for Groupings of Penetrants:
1. UL-Classified Systems: F-A-8001-8999 (floors) and W-L-8001-8999 (walls).
2. F-Rating: 1 hour minimum.
3. Type of Fill Materials: As required to achieve rating.
4.

**END OF SECTION 07 84 13**

# SECTION **07 84 46** - **FIRE-RESISTIVE JOINT 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. Joints in or between fire-resistance-rated constructions.

B. Related Sections:
   1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
   2. Section 07 95 00 "Expansion Control" for fire-resistive architectural joint systems.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For sealants, sealant primers, and caulks, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of sealant, sealant primer, or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
   1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Qualification Data: For qualified Installer.

E. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify DSA Project Inspector at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases,

and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
   3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hilti, Inc.
      b. RectorSeal Corporation.
      c. 3M Fire Protection Products.
      d. Tremco, Inc.; Tremco Fire Protection Systems Group.

C. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Low-Emitting Materials: Fire-resistive joint system 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."

E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

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

### 3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

## 3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

## 3.5 FIELD QUALITY CONTROL

A. The DSA Project Inspector will observe the installation and perform tests and inspections as required per ASTM E 2174 “Standard Practice for On-Site Inspection of Installed Fire Stops.”

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

## 3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

## 3.7 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN.

B. Wall-to-Wall, Fire-Resistive Joint Systems FRJS-1:
   1. UL-Classified Systems: WW-D-0000-0999.
   2. Assembly Rating: 1 hour.
   3. Nominal Joint Width: 2 inches (maximum).
   4. Movement Capabilities: Class II - 12.5 percent compression or extension.

C. Head-of-Wall, Fire-Resistive Joint Systems FRJS-2:
   1. UL-Classified Systems: HW-D 0000-0999.
   2. Assembly Rating: 1 hour.
   3. Nominal Joint Width: 1 inch (maximum).
   4. Movement Capabilities: Class II - 33 percent compression or extension.

**END OF SECTION 07 84 46**

# SECTION **07 92 00** - **JOINT SEALANTS**

## 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. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Related Requirements:
1. Section 07 92 19 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
2. Refer to sections of Divisions 21, 22, 23, 26, 27, and 28 for joint sealers in mechanical, electrical, and plumbing work not called for in this section.
3. Section 32 13 73 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

C. General Performance; Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicatd for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

### 1.3 SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Installation Instructions: Manufacturer’s written installation instructions for products and applications indicated for each joint-sealant product.

C. California Green Building Standards Code (GBC) Submittals:
1. Product Data: For sealants, sealant primers, and caulks, documentation indicating that products:
   a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2016 California Green Building Standards Code).
   b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
2. Product Data: For smaller unit sizes of sealant, sealant primer, or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
   a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

D. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

E. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

F. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

B. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

C. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 100/50, Uses T and NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, 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. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish systems.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without

deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces **JS-1**.
   1. Joint Locations:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicon, S, P, 100/50, T.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces **JS-2**.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Joints in exterior porcelain tile cladding.
      c. Joints in exterior insulation and finish systems.
      d. Joints between metal panels.
      e. Joints between different materials listed above.
      f. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
      g. Control and expansion joints in ceilings and other overhead surfaces.
      h. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces **JS-3**.
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicon, S, P, 100/50, T.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces **JS-4**.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Tile control and expansion joints.
      c. Vertical joints on exposed surfaces of cast-in-place concrete stem walls and curbs.
      d. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement **JS-5**.
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Acrylic latex.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces **JS-6**.
   1. Joint Locations:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Inside corners of ceramic tile walls and wainscot surfaces.
      d. Perimeter joints between interior ceramic tile wall surfaces and frames of interior doors.
      e. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Concealed mastics **JS-7**.
   1. Joint Locations:
      a. Aluminum thresholds.
      b. Sill plates.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Butyl-rubber based.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

# SECTION **07 92 19** - **ACOUSTICAL JOINT SEALANTS**

## 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 acoustical joint sealants.

B. Related Requirements:
   1. Section 07 92 00 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

### 1.3 SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For acoustical sealants, sealant primers, and caulks, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2016 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of acoustical sealant, sealant primer, or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Acoustical-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

E. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Sample Warranties: For special warranties.

1.4 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

B. Low-Emitting Interior Sealants: Acoustical sealants and sealant primers shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
   1. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, 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. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

### 3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

### 3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

# SECTION **07 95 00** - **EXPANSION CONTROL**

## 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. Interior expansion control systems.
2. Exterior wall expansion control systems.
3. Open-air structure expansion control systems.

B. Related Requirements:
1. Section 07 71 29 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion control.
2. Section 07 92 00 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

### 1.3 SUBMITTALS

A. Shop Drawings: For each expansion control system specified.
1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, blockout requirement, intersections, transitions, fittings, methods of field assembly, and locations and size of each field splice.
3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches long in size.

C. Samples for Initial Selection: For each type of expansion control system indicated.
1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
1. Manufacturer and model number for each expansion control system.
2. Expansion control system location cross-referenced to Drawings.
3. Nominal joint width.
4. Movement capability.
5. Classification as thermal or seismic.
6. Materials, colors, and finishes.
7. Product options.
8. Fire-resistance ratings.

E. Product Test Reports: For each fire barrier provided as part of an expansion control system, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

B. Coordination: Coordinate installation of exterior wall and soffit expansion control systems with roof expansion control systems to ensure that wall transitions are watertight. Roof expansion joint assemblies are specified elsewhere.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the Title 24, Part 2, California Building Code.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
   2. Component Importance Factor is 1.25.

2.3 INTERIOR EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
   1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
   2. Balco, Inc.
   3. Construction Specialties, Inc.
   4. MM Systems Corporation.
   5. Nystrom, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
   1. Basis-of-Design Product: Indicated on Drawings.
   2. Design Criteria:
      a. Nominal Joint Width: 4 inches.
      b. Minimum Joint Width: 2 inches.
      c. Maximum Joint Width: 6 inches.
      d. Type of Movement: Seismic.
      e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
   3. Type: Cover plate.

a. Metal: Aluminum.
1) Finish: Clear anodic, Class II.

D. Wall Corner:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
a. Nominal Joint Width: 4 inches.
b. Minimum Joint Width: 2 inches.
c. Maximum Joint Width: 6 inches.
d. Type of Movement: Seismic.
e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
3. Type: Cover plate.
a. Metal: Aluminum.
1) Finish: Clear anodic, Class II.

E. Wall-to-Ceiling:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
a. Nominal Joint Width: 4 inches.
b. Minimum Joint Width: 2 inches.
c. Maximum Joint Width: 6 inches.
d. Type of Movement: Seismic.
e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
3. Type: Cover plate.
a. Metal: Aluminum.
1) Finish: Clear anodic, Class II.

F. Ceiling-to-Ceiling:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
a. Nominal Joint Width: 4 inches.
b. Minimum Joint Width: 2 inches.
c. Maximum Joint Width: 6 inches.
d. Type of Movement: Seismic.
e. Fire-Resistance Rating: Provide expansion control system and fire-barrier assembly with a rating not less than that of adjacent construction.
3. Type: Cover plate.
a. Metal: Aluminum.
1) Finish: Clear anodic, Class II.

2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
2. Balco, Inc.
3. Construction Specialties, Inc.
4. MM Systems Corporation.
5. Nystrom, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:

1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
   a. Nominal Joint Width: 4 inches.
   b. Minimum Joint Width: 2 inches.
   c. Maximum Joint Width: 6 inches.
   d. Type of Movement: Seismic.
3. Type: Cover plate.
   a. Metal: Aluminum.
      1) Finish: Mill.

D. Wall Corner:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
   a. Nominal Joint Width: 4 inches.
   b. Minimum Joint Width: 2 inches.
   c. Maximum Joint Width: 6 inches.
   d. Type of Movement: Seismic.
3. Type: Cover plate.
   a. Metal: Aluminum.
      1) Finish: Mill.

E. Wall-to-Soffit:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
   a. Nominal Joint Width: 4 inches.
   b. Minimum Joint Width: 2 inches.
   c. Maximum Joint Width: 6 inches.
   d. Type of Movement: Seismic.
3. Type: Cover plate.
   a. Metal: Aluminum.
      1) Finish: Mill.

F. Soffit-to-Soffit:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
   a. Nominal Joint Width: 4 inches.
   b. Minimum Joint Width: 2 inches.
   c. Maximum Joint Width: 6 inches.
   d. Type of Movement: Seismic.
3. Type: Cover plate.
   a. Metal: Aluminum.
      1) Finish: Mill.

2.5 OPEN-AIR STRUCTURE EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
2. Balco, Inc.
3. Construction Specialties, Inc.
4. JointMaster/InPro Corporation.
5. MM Systems Corporation.
6. Nystrom, Inc.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Slab-to-Slab:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
a. Nominal Joint Width: 4 inches.
b. Minimum Joint Width: 2 inches.
c. Maximum Joint Width: 6 inches.
d. Type of Movement: Seismic.
e. Load Capacity:
1) Uniform Load: 150 lb/sq. ft..
2) Concentrated Load: 2000 lb.
3) Maximum Deflection: 0.5 inch.
3. Type: Metal plate.
a. Metal: Stainless steel.
1) Finish: No. 4.
b. Attachment Method: Mechanical anchors.

D. Slab-to-Wall:
1. Basis-of-Design Product: Indicated on Drawings.
2. Design Criteria:
a. Nominal Joint Width: 4 inches.
b. Minimum Joint Width: 2 inches.
c. Maximum Joint Width: 6 inches.
d. Type of Movement: Seismic.
3. Type: Metal plate.
a. Metal: Stainless steel.
1) Finish: No. 4.
b. Attachment Method: Mechanical anchors.

2.6 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.
1. Drain-Tube Assemblies: Equip moisture barrier with drain tubes and seals to direct collected moisture to exterior-wall expansion control system.

2.7 MATERIALS

A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304 for plates, sheet, and strips.
1. Remove tool and die marks and stretch lines or blend into finish.

C. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.

E. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

F. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required fire-resistance rating.

G. Moisture Barrier: Flexible elastomeric material.

H. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

I. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

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

2.9 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.10 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
5. Install frames in continuous contact with adjacent surfaces.
   a. Shimming is not permitted.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces before installing compression seals.

E. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet or where indicated on Drawings.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary

protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

**END OF SECTION 07 95 00**

# SECTION **08 11 13** - **HOLLOW METAL DOORS AND FRAMES**

## 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 hollow-metal work.

B. Related Requirements:
1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

### 1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

### 1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

### 1.5 SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, core descriptions, and finishes.

B. Installation Instructions: Manufacturer’s written installation instructions for each type of product.

C. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

E. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door & frame to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ceco Door Products; an Assa Abloy Group company.
2. Door Components, Inc.
3. Curries Company; an Assa Abloy Group company.
4. Mesker Door Inc.
5. Pioneer Industries, Inc.
6. Security Metal Products Corp.
7. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
   a. Type: As indicated in the Door Schedule on drawings.
   b. Thickness: 1-3/4 inches.
   c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.053 inch (16 gauge).
   d. Edge Construction: Model 2, Seamless.
   e. Core: Polyurethane.
3. Frames:
   a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.067 inch (14 gauge).
   b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
a. Type: As indicated in the Door Schedule on drawings.
b. Thickness: 1-3/4 inches
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (16 gauge), with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Polyurethane.
1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than R-11 when tested according to ASTM C 518.
3. Frames:
a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (14 gauge), with minimum A60 coating.
b. Construction: Full profile welded. (Custom shape, see drawings for profile.)
4. Exposed Finish: Prime.

2.4 HOLLOW-METAL PANELS

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.7 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
1. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
2. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
3. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide flat -head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      1) Three anchors per jamb up to 60 inches high.
      2) Four anchors per jamb from 60 to 90 inches high.
      3) Five anchors per jamb from 90 to 96 inches high.
      4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of hollow-metal work.
   5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## 2.9 ACCESSORIES

A. Metal Security Louvers: Provide louvers for door, where indicated, which comply with SDI 111C.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anemostat; a Mestek company; PLSL.
      b. Air Louvers Inc.; 1500-ASG.
   2. Blade Type: Vision-proof, inverted Y.
   3. Metal and Finish: Hot-dip galvanized steel, Frame & Grille: minimum 0.096 inch thick (12 gauge), Louver Blades: minimum 0.040 inch thick (18 gauge), factory primed for paint finish.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

## 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 the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

### 3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      b. Install frames with removable stops located on secure side of opening.
      c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
   4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk tamperproof flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

**END OF SECTION 08 11 13**

# SECTION **08 14 16** - **FLUSH WOOD DOORS**

## 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. Solid-core doors with wood-veneer faces.
   2. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
   1. Section 08 11 13 “Hollow Metal Doors and Frames” for flush wood doors in steel frames.
   2. Section 08 71 00 “Door Hardware” for door hardware for flush wood doors.
   3. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
   4. Section 09 91 00 “Painting and Finishing” for field finishing doors.

### 1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.

B. Installation Instructions: Manufacturer’s written installation instructions for each type of product.

C. California Green Building Standards Code Submittals:
   1. Laboratory Test Reports: For adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Laboratory Test Reports: For composite wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Undercuts.
   5. Fire-protection ratings for fire-rated doors.

F. Samples for Verification:
   1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
   2. Louver blade and frame sections, 6 inches long, for each material and finish specified.
   3. Frames for light openings, 6 inches long, for each material, type, and finish required.

G. Sample Warranty: For special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.6 WARRANTY

A. A. Special Warranty: 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 in a 42-by-84-inch section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Graham Wood Doors; ASSA Abloy
   2. ABS – American Building Supply – Doormerica
   3. Algoma Hardwoods, Inc.
   4. Eggers Industries
   5. Haley Brothers, Inc.

6. Marshfield Door Systems, Inc.
7. Oregon Door
8. Oshkosh Door Company
9. Vancover Door Company

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
   1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

D. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.

2.3 DOORS FOR OPAQUE FINISH

A. Interior Solid-Core Doors:
   1. Grade: Custom.
   2. Faces: Paint Grade Birch.
   3. Exposed Vertical and Top Edges: Paint Grade Birch.
   4. Core: Particleboard.
   5. Construction: Five plies. Stiles and rails are bonded to core and then entire unit is abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

C. Metal Security Louvers: Provide louvers for door, where indicated, which comply with SDI 111C.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anemostat; a Mestek company; PLSL.
      b. Air Louvers Inc.; 1500-A.

c. L&L Louvers Inc.; SZ-70AS

2. Blade Type: Vision-proof, inverted Y.
3. Metal and Finish: Hot-dip galvanized steel, Frame & Grille: minimum 0.096 inch thick (12 gauge), Louver Blades: minimum 0.040 inch thick (18 gauge), factory primed for paint finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

# SECTION **08 31 13** - **ACCESS DOORS AND FRAMES**

## 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. Access doors and frames for walls and ceilings.

B. Related Requirements:
   1. Section 07 72 00 "Roof Accessories" for roof hatches.
   2. Section 21 00 00 “Basic Fire Protection Requirements” for fire protection access doors and panels.
   3. Section 22 00 00 “Basic Plumbing Requirements” for plumbing systems access doors and panels.
   4. Section 23 00 00 "Basic HVAC Requirements" for heating and air-conditioning access doors and panels.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

### 1.4 DELIVERY, STORAGE AND HANDLING

A. Package and ship according to manufacturer's recommendations. Provide additional sealed plastic wrapping for factory finished access doors.

B. Inspect access doors upon delivery for damage. Remove and replace damaged items.

C. Store access doors at building site under cover in dry area out of direct sunlight. Place units on wood sills at least 4 inches high, or otherwise store on floors in manner that will prevent rust and damage. Avoid use of non-vented plastic or canvas shelters, which could create humidity chamber.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Stainless Steel Access doors shall be provided in Toilet Room walls.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
   1. Acudor Products, Inc.
   2. Babcock-Davis.
   3. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
   4. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   5. Karp Associates, Inc.
   6. Larsen's Manufacturing Company.
   7. Milcor Inc.
   8. Nystrom, Inc.
   9. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges (Keynote #08 31 13.A1):
   1. Basis-of-Design Product: Nystrom, Inc.; Flush Door Series: Model NT
   2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   3. Locations: Wall and ceiling.
   4. Door Size: As Indicated on Drawings.
   5. Metallic-Coated Steel Sheet for Door: Nominal 0.079 inch, 14 gauge.
      a. Finish: Factory prime.
   6. Frame Material: Same material and finish as door.
      a. Finish: Nominal 0.064, 16 gauge.
   7. Hinges: Concealed Continuous Piano Type.
   8. Hardware: Key operated cylinder cam lock with 2 keys per lock, keyed alike.

D. Flush Access Doors with Exposed Flanges (Keynote #08 31 13.A2):
   1. Basis-of-Design Product: Nystrom, Inc.; Flush Door Series: Model NT
   2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
   3. Locations: Wall and ceiling.
   4. Door Size: As Indicated on Drawings.
   5. Stainless-Steel Sheet for Door: Nominal 0.078 inch, 14 gauge.
      a. Finish: No. 4.
   6. Frame Material: Same material and finish as door.
      a. Thickness: Nominal 0.062 inch, 16 gauge
   7. Hinges: Concealed Continuous Piano Type.
   8. Hardware: Key operated cylinder cam lock with 2 keys per lock, keyed alike.

E. Flush Access Doors with Concealed Flanges (Keynote #08 31 13. A3):
   1. Basis-of-Design Product: Nystrom, Inc.; Flush Door Series: Model NW.
   2. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.

3. Locations: Wall and ceiling.
4. Door Size: As Indicated on Drawings.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.079 inch, 14 gauge.
   a. Finish: Factory prime.
6. Frame Material: Same material as door .
   a. Thickness: Nominal 0.064 inch, 16 gauge.
7. Hinges: Concealed Continuous Piano Type.
8. Hardware: Key operated cylinder cam lock with 2 keys per lock, keyed alike.

F. Flush Access Doors with Concealed Flanges (Keynote #08 31 13.A4):
1. Basis-of-Design Product: Nystrom, Inc.; Flush Door Series: Model NW.
2. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
3. Locations: Wall.
4. Door Size: As Indicated on Drawings.
5. Stainless-Steel Sheet for Door: Nominal 0.078 inch, 14 gauge.
   a. Finish: No. 4.
6. Frame Material: Same material as door.
   a. Thickness: Nominal 0.062 inch, 16 gauge.
7. Hinges: Concealed Continuous Piano Type.
8. Hardware: Key operated cylinder cam lock with 2 keys per lock, keyed alike.

G. Recessed Access Doors (Keynote #08 31 13.A8):
1. Basis-of-Design Product: Nystrom, Inc.; Recessed Access Door Series: Model RA.
2. Assembly Description: Fabricate door in the form of a pan recessed 5/8 inch acoustical tile infill. Provide frame with no bead for acoustical tile installation.
3. Locations: Ceiling.
4. Door Size: As indicated on drawings.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gauge.
   a. Finish: Factory prime.
6. Frame Material: Same material and thickness as door.
7. Hinges: Concealed Continuous Piano Type.
8. Hardware: Key operated cylinder cam lock with 2 keys per lock, keyed alike.

H. Exterior Flush Access Doors (Keynote #08 31 13.A5):
1. Basis-of-Design Product: Nystrom, Inc. Exterior Access Doors Series: Model XT.
2. Assembly Description: Fabricate door to be weatherproof and fit flush to frame. Provide manufacturer's standard 2-inch- thick foam insulation and extruded door gaskets. Provide manufacturer's standard-width frame for surface mounting, proportional to door size.
3. Locations: Wall and ceiling.
4. Door Size: As indicated on Drawings.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gauge.
   a. Finish: Factory prime.
6. Frame Material: 6063-T5 extruded aluminum, 0.080 inch, Mill.
7. Hinges: Stainless Steel Continuous Piano Type.
8. Hardware: 1/4 Turn Lock with 2 removable keys.

## 2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

E. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

F. Frame Anchors: Same type as door face.

G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
   2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
   3. Provide mounting holes in frames for attachment of units to metal or wood framing.
   4. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder locks, furnish two keys per lock and key all locks alike.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

## 2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

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

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless-Steel Finishes:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   a. Run grain of directional finishes with long dimension of each piece.
   b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
   c. Directional Satin Finish: No. 4.

F. Aluminum Finishes:
1. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

**END OF SECTION 08 31 13**

# SECTION **08 33 23** - **OVERHEAD COILING DOORS**

## 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. Insulated service doors.

B. Related Sections:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

### 1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
   1. Wind Loads:
      a. Basic Wind Speed ($V_{ult}$): 115 mph.
      b. Exposure Category: C.
      c. Component level wind pressure: 33 psf.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

B. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

C. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   2. Seismic Component Importance Factor: 1.25.

D. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

### 1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   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. Show locations of replaceable fusible links.
   3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates: For overhead coiling doors, accessories, and components, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.336 (22 gauge) and as required to meet requirements.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
   4. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

B. Endlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch (24 gauge) - thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

2.3 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: Provide cylinders specified in Section 08 71 00 "Door Hardware" and keyed to building keying system.
2. Keys: Specified in Section 08 71 00 “Door Hardware.”

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.4 CURTAIN ACCESSORIES

A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
1. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of hood.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
   1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 11 05 13 "Common Motor Requirements for Equipment" unless otherwise indicated.
   1. Electrical Characteristics:
      a. Phase: Polyphase.
      b. Volts: 208 V.
      c. Hertz: 60.
   2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
   3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
   4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
   1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.7 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Cookson Company; FMWI Motor Operated Insulated Service Door with Featheredge or comparable product by one of the following:
a. Cornell Iron Works, Inc.
b. Lawrence Roll-Up Doors, Inc.
c. Overhead Door Corporation.
d. Raynor.
e. Wayne-Dalton Corp.

B. Operation Cycles: Not less than 50,000.
1. Include tamperproof cycle counter.

C. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 3 inches center-to-center height.
1. Insulated-Slat Interior Facing: Metal.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

G. Hood: Match curtain material and finish.
1. Shape: Round.
2. Mounting: Face of wall.

H. Locking Devices: Equip door with locking device assembly.
1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with cylinder.

I. Electric Door Operator:
1. Usage Classification: Industrial Duty up to 25 cycles per day.
2. Operator Location: Front of hood.
3. Motor Exposure: Interior.
4. Emergency Manual Operation: Chain type.

5. Obstruction-Detection Device: Manufacturer’s standard Automatic Sensor Edge.
   a. Sensor Edge Bulb Color: Black.
6. Remote-Control Station: Interior.

J. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

**END OF SECTION 08 33 23**

# SECTION **08 41 13** - **ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

## 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. Exterior storefront framing.
2. Exterior manual-swing entrance doors.

B. Related Requirements:
1. Section 08 71 00 “Finish Hardware” for aluminum-framed entrance hardware.
2. Section 08 80 00 “Glazing” for insulated glazing units for aluminum-framed entrances and storefronts.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code Submittals:
1. Laboratory Test Reports: For glazing sealants used inside the weatherproofing system, documentation indicating that products 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. **DSA Deferred Approval Submittal**: Aluminum-framed entrances and storefronts with spans over 10’-0” (includes width of storefront section) are a Division of the State Architect (DSA) Deferred Approval.
1. Design aluminum-framed entrances and storefronts, including comprehensive engineering analysis by a California registered Civil or Structural Engineer, using performance requirements and design criteria indicated.
2. Provide a minimum of 3 stamped and wet-signed copies of drawings, specifications, and structural calculations prepared and signed by a California Registered Civil or Structural Engineer to the Architect for review and submittal to DSA for review and approval. These are in addition to the number of shop drawings/submittal documents necessary for review by the Architect during the submittal review process.
3. The Architect and/or Structural Engineer in general responsible charge shall review the submittal and affix a statement of general conformance per DSA IR-18 before submitting to DSA for review and approval.
4. Fabrication and installation shall not begin until DSA approval.

D. Shop Drawings (included as part of the DSA Deferred Approval Submittal): For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

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

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Qualification Data: For Installer.

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

I. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

J. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

C. Accessibility Requirements: For door hardware on entrance doors required to be accessible, comply with applicable provisions in CCR Title 24, Part 2, California Building Code – Accessibility Standards as enforced by DSA.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 pounds.
2. Hand-activated hardware such as lever latchsets, panic bars, push-pull handles, and lever handle thumb-turn dead bolts shall be mounted between 34” to 44” above finish floor.

3. Comply with the following maximum opening-force requirements:
a. Exterior, Entrance Doors: 5 pounds applied perpendicular to entrance door.
4. Thresholds: The floor or landing shall not be more than ½ inch lower than the threshold of the doorway. Change in level between ¼ inch and ½ inch shall be beveled with a slope no greater than one unit vertical in two units horizontal (50 percent slope.
5. Adjust door closers sweep periods (Delayed Action Feature) so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum, measured to the leading edge of the door.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a California registered structural engineer to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads:
      a. Basic Wind Speed ($V_{ult}$): 115 mph.
      b. Exposure Category: C.

c. Component level wind pressure: 29 psf in field and 33 psf within 10'-0" of the corners of the building.

2. Seismic Loads:
   a. Seismic Importance Factor ($I_e$): 1.25
   b. Short Period Design Spectral Response Acceleration ($S_{DS}$): 0.693g
3. Seismic Loads: Exterior Nonstructural Wall Elements and Connections (ASCE/SEI 7-10 Table 13.5-1)
   a. Wall Element: $a_p$ = 1.0 and $R_p$ = 2.5
   b. Body of wall panel connections: $a_p$ = 1.0 and $R_p$ = 2.5
   c. Fasteners of the connecting system: $a_p$ = 1.25 and $R_p$ = 1.0

D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
   a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
   a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..
2. Entrance Doors:
   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and Chapter 16A of the 2013 California Building Code.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.50 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

J. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
   1. Outdoor-Indoor Transmission Class (OITC): Minimum 30.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
   2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
      c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; Trifab 451 UT or comparable product by one of the following:
   1. Oldcastle Building Envelope.
   2. Arcadia, Inc.
   3. EFCO Corporation.
   4. US Aluminum.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Center.
   4. Finish: Color anodic finish.
   5. Fabrication Method: Field-fabricated stick system.

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

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

D. Materials:
   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      a. Sheet and Plate: ASTM B 209.
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
      c. Extruded Structural Pipe and Tubes: ASTM B 429.
      d. Structural Profiles: ASTM B 308.
   2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
      a. Structural Shapes, Plates, and Bars: ASTM A 36.

b. Cold-Rolled Sheet and Strip: ASTM A 1008.
c. Hot-Rolled Sheet and Strip: ASTM A 1011.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware" and on drawings.

2.6 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

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

C. Sealants used inside the weatherproofing system 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."

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

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

C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

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

E. Storefront Framing: Fabricate components for assembly using screw-spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

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

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

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

3.3 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

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

C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

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

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 08 80 00 "Glazing."

G. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

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

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.

b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 MAINTENANCE SERVICE

A. Entrance Door Hardware:
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 41 13

# SECTION **08 45 23** - **FIBERGLASS-SANDWICH-PANEL ASSEMBLIES**

## 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 aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:
   1. Wall assemblies.

### 1.3 SUBMITTALS

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

B. List of completed school projects (five minimum) where submitted Fiberglass-Sandwich-Panel Assemblies were installed under the 2013 or 2016 California Building Code with Thermally Broken construction. Include DSA numbers, name of school districts, and name of Architects.

C. **DSA Construction Changes Submittal (substitution for Basis of Design Product)**: For this project, substituted Fiberglass-Sandwich-Panel Assemblies are a Division of the State Architect (DSA) Construction Change to the DSA approved plans.
   1. Design Fiberglass-Sandwich-Panel Assemblies, including comprehensive engineering analysis by a California registered Civil or Structural Engineer, using performance requirements and design criteria indicated.
   2. Provide a minimum of 3 stamped and wet-signed copies of drawings, specifications, and structural calculations prepared and signed by a California Registered Civil or Structural Engineer to the Architect for review and submittal to DSA for review and approval. These are in addition to the number of shop drawings/submittal documents necessary for review by the Architect during the submittal review process.
   3. The Architect and/or Structural Engineer in general responsible charge shall review the submittal and affix a statement of general conformance per DSA IR-18 before submitting to DSA for review and approval.
   4. The Architect in general responsible charge shall submit the documents to DSA per DSA IR-A6 for review and approval.
   5. Fabrication and installation shall not begin until DSA approval.

D. Shop Drawings: For panel assemblies.
   1. Include plans, elevations, sections, details, and anchorage details for attachments to other work and components within the panel assembly.
   2. Include complete member material, dimensions, and properties.
   3. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.

4. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

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

F. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:
1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Fiberglass-sandwich panels.
5. Flashing and drainage.

G. Qualification Data: For qualified Installer and manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for panel assemblies.

I. Warranties: Sample of special warranties.

## 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC177, "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems." The manufacturer shall have successfully completed a minimum of five school projects under the 2013 or 2016 California Building Code with Thermally Broken construction.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of panel assemblies required for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for panel assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

## 1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   c. Water leakage.
2. Warranty Period: Two years from date of Substantial Completion.

B. Special Fiberglass-Sandwich-Panel Warranty: Manufacturer's standard form in which manufacturer agrees to replace panels that exhibit defects in materials or workmanship.
1. Defects include, but are not limited to, the following:
   a. Fiberbloom.
   b. Delamination of coating, if any, from exterior face sheet.
   c. Color change exceeding requirements.
   d. Delamination of panel face sheets from panel cores.
2. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide **Kalwall Corporation 2 ¾" Wall System. (ATI-ES CCRR-0173 and ICC ESR-2464)**

B. A substitution to the above Basis-of-Design Product requires DSA approval before acceptance by the architect and the school district. The cost for obtaining DSA approval shall be at no additional cost to the school district.

### 2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Fiberglass-sandwich-panel assemblies shall withstand the effects of the following forces without failure due to defective manufacture, fabrication, installation, or other defects in construction:
1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes, but is not limited to, the following:
   a. Deflection exceeding specified limits.
   b. Water leakage.
   c. Thermal stresses transferred to building structure.
   d. Noise or vibration created by wind, thermal, or structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.

B. Structural Loads:
1. Wind Loads:
   a. Basic Wind Speed ($V_{ult}$): 115 mph.
   b. Exposure Category: C.
   c. Component level wind pressure: 30.5 psf.
2. Seismic Loads:
   a. Seismic Importance Factor ($I_e$): 1.25
   b. Short Period Design Spectral Response Acceleration ($S_{DS}$): 0.693g

3. Seismic Loads: Exterior Nonstructural Wall Elements and Connections (ASCE/SEI 7-10 Table 13.5-1)
   a. Wall Element: $a_p$ = 1.0 and $R_p$ = 2.5
   b. Body of wall panel connections: $a_p$ = 1.0 and $R_p$ = 2.5
   c. Fasteners of the connecting system: $a_p$ = 1.25 and $R_p$ = 1.0

C. Deflection Limits:
   1. Vertical Panel Assemblies: Limited to 1/120 of clear span for each assembly component.

D. Structural-Test Performance: Provide panel assemblies tested according to ASTM E 330, as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding **0.2** percent of span.
   3. Test Durations: As required by design wind velocity, but not less than **10** seconds.

E. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

F. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

G. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC:
   1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than what is shown in **3.3 - Panel Schedule** as determined according to NFRC 100.
   2. Solar-Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than what is shown in **3.3 - Panel Schedule** as determined according to NFRC 200.
   3. Visible Light Transmission (VLT): Fixed glazing shall have a visible light transmission of not more than what is shown in **3.3 – Panel Schedule** as determined according to ASTM E972.
   4. Condensation Resistance Factor (CRF): Thermally broken panels shall give a minimum CRF of 80 by AAMA 1503 measured on the grid line.
   5. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.01 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

## 2.3 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308.

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

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
   1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.
   2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Exposed Flashing and Closures: Aluminum sheet not less than 0.050 inch thick, finished to match framing.

G. Framing Gaskets: Manufacturer's standard.

H. Frame-System Sealants: As recommended in writing by manufacturer and as submitted to and reviewed by Architect.

I. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.4 FIBERGLASS-SANDWICH PANELS

A. Description: Assembly of uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.
   1. Self-Ignition Temperature: 650 deg F or more per ASTM D 1929.
   2. Smoke-Developed Index: 450 or less per ASTM E 84, or 75 or less per ASTM D 2843.
   3. Flame-Spread Index: Not more than 25 per ASTM E 84.
   4. Combustibility Classification: Class CC1 per ASTM D 635.
   5. Interior Finish Classification: Class A per ASTM E 84.

B. Panel Thickness: 2-3/4 inches.

C. Panel Strength Characteristics:
   1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested according to ASTM E 72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
   2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch- diameter disk according to ASTM E 661.

D. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.
   1. Extruded Aluminum: ASTM B 221, in alloy and temper recommended in writing by manufacturer.
   2. I-Beam Construction: Thermally broken, extruded aluminum..
   3. Grid Pattern: Inline rectangle (Shoji Pattern), nominal 12 by 24 inches.

E. Exterior Face Sheet:
   1. Thickness: 0.070 inches.
   2. Color: White.
   3. Color Change: Not more than 3.0 units Delta E when measured according to ASTM D 2244, after outdoor weathering in southern Florida compliant with procedures in ASTM D 1435, with panels mounted facing south and as follows:
      a. Panel Mounting Angle: Not more than 5 degrees from horizontal.
      b. Exposure Period: 60 months.
   4. Erosion Protection: Integral, embedded-glass erosion barrier.

F. Interior Face Sheet:
   1. Thickness: 0.045 inch minimum.
   2. Color: White.

G. Fiberglass-Sandwich-Panel Adhesive: ASTM D 2559.
   1. Compatible with facing and core materials.
   2. Tensile and shear bond strength of aged adhesive ensures permanent adhesion of facings to cores, as evidenced by testing tensile strength according to ASTM C 297 and shear bond strength according ASTM D 1002. Use accelerated aging procedures that comply with aging requirements for adhesives with high resistance to moisture in ICC-ES AC05, "Sandwich Panel Adhesives."

## 2.5 FABRICATION

A. Frame System Fabrication:
   1. Fabricate components before finishing.
   2. Fabricate components that, when assembled, have the following characteristics:
      a. Profiles that are sharp, straight, and free of defects or deformations.
      b. Accurately fitted joints with ends coped or mitered.
      c. Internal guttering systems or other means to drain water passing through joints, condensation occurring within components, and moisture migrating within assembly to exterior.
   3. Fabricate sill closures with weep holes and for installation as continuous component.
   4. Reinforce components as required to receive fastener threads.

B. Panel Fabrication: Factory assemble and seal panels.
   1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
      a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. of panel and limited in diameter to 3/64 inch.
   2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
   3. Fabricate panel to allow condensation within panel to escape.
   4. Reinforce panel corners.

2.6 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color: Equal to Kalwall Corporation, Color #85 - Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions as submitted to and reviewed by Architect during the submittal process.
   2. Do not install damaged components.
   3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
   6. Seal joints watertight unless otherwise indicated.
   7. Attach panels per DSA approved drawings.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters.

D. Install components to drain water passing through joints, condensation occurring within aluminum members and panels, and moisture migrating within assembly to exterior.

E. Install components plumb and true in alignment with established lines and elevations.

F. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
   1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
   2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 PANEL SCHEDULE

| A. | B. | C. | D. | E. | F. | G. |
|---|---|---|---|---|---|---|
| Area | Walls | Exterior Panel Face | Interior Panel Face | | U Factor | SHGC |
| H. | I. | J. | K. | L. | M. | N. |
| Clerestory | Wall Panel | White | White | | 0.23 | 0.23 |

O.

**END OF SECTION 08 45 23**

# SECTION **08 51 13** - **ALUMINUM WINDOWS**

## 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 aluminum windows for exterior locations.

B. Related Requirements:
   1. Section 08 80 00 "Glazing" for Insulated Dual Glazing Units.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, accessories, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Qualification Data: For manufacturer and Installer.

F. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

G. Sample Warranties: For manufacturer's warranties.

### 1.4 QUALITY ASSURANCE

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

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of materials and finishes beyond normal weathering.
      e. Failure of insulating glass.
   2. Warranty Period:
      a. Window: 10 years from date of Substantial Completion.
      b. Aluminum Finish: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **All-Weather Architectural Aluminum; Series 5000** or comparable product by one of the following:
   1. Thermal Windows, Inc.; Series 850 (fixed) and Series 835 (Hopper)
   2. EFCO Corporation; a Pella company.
   3. Win-Vent Architectural; Series 350

B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: C.
   2. Minimum Performance Grade: 50.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.53 Btu/sq. ft. x h x deg F.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

E. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

F. Sound Transmission Class (STC): Rated for not less than 35 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

G. Outside-Inside Transmission Class (OITC): Rated for not less than 32 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

## 2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Fixed/Hopper (project in) Combination.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: See Section 08 80 00 “Glazing.”

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907 or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: Brushed Nickel.

F. Hopper Window Hardware:
   1. Hinges: 4-bar heavy duty stainless steel**,** not less than two per sash.
   2. Lock: Key-operated custodial lock with keeper and removable handle. Provide a minimum of one (1) key per room.
   3. Limit Devices: manufacturer’s standard limit devices designed to restrict sash opening.
      a. Limit clear opening to **8 inches** (4 inches maximum at path of travel as measured from inside face of wall) for ventilation; with custodial key release.

G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

## 2.4 ACCESSORIES

A. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Nail Fin: Integral or snap-on perimeter fin for securing window assembly to the building framing by means of mechanical fasteners.

D. Window Flashing System: ASTM E 2112 and AAMA 2400-02

E. 1.Basis of Design Product: Fortifiber Building Systems Group; High Performance Window Flashing System.

F. a.Head Flashing: 12 inch high x 20 mil thick Fortiflash Butyl Waterproof Flashing.

G. b. Base Flashing (sill and jambs): 9 inch wide Moistop PF Flashing.

H. c. Jamb Flashing: 6 inch wide Moistop E-Z Seal Adhesive Flashing.

I. 2.Sealant: **Fortifiber Building Systems Group; Moistop Sealant**; modified polymer, one-component balanced modulus, moisture curing, non-sag elastomeric sealant.

J. a.AAMA 808.3-92 (Exterior Perimeter Sealing Compound); ASTM C-920 Type S, Grade NS, Class 25.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
1. Type and Location: Full, outside for project-in sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Glass-Fiber Mesh Fabric: 18-by-14 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656.
1. Mesh Color: Charcoal.

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Windows to be Outside Glazed.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

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

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

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
   1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112 and AAMA 2400-02.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction. Install window flashing system per manufacturer’s written installation instructions.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

**END OF SECTION 08 51 13**

# SECTION 08 62 00 - TUBULAR SKYLIGHTS

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Work included: Provide Tubular Skylights as specified herein.

B. Related work specified elsewhere

1. Section 05 31 00 – Steel Decking
2. Section 07 51 13 – Built-up Asphalt Roofing
3. Section 07 72 00 – Roof Accessories for skylight curb
4. Section 09 21 16.23 – Gypsum Board Shaft Wall Assemblies

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 SUBMITTALS

A. Product Data: Within 21 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

3. Shop Drawings showing installation details for tubular skylights

4. Manufacturer's recommended installation procedures which when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.5 PRODUCT HANDLING

A. Delivery and storage:

1. Deliver materials to the job site properly marked to identify the location for which they are intended.

2. Use markings corresponding to markings shown on the approved Shop Drawings.

3. Store in a manner to maintain identification and prevent damage, off the ground, using pallets or other supports, and to permit easy access for inspection.

2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Tubular Skylight Manufacturer: Subject to compliance with the requirements, provide skylights units of the following:

1. Solatube International, Inc. **(Basis of Design Product)**
2210 Oak Ridge Way
Vista, CA 92083
(760) 597-4425

2. Velux America, Inc.
104 Ben Casey Drive
Fort Mill, SC 29708
(800) 888-3589

3. Architect and District approved equal.

2.2 TUBULAR SKYLIGHTS:

A. General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16. All components made and assembled by one manufacturer.

B. Brighten Up Series: Solatube Model 290 DS: 14 Inch (350 mm) Daylighting System:

1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

a. Outer Dome Glazing: Type DA, 0.125 inch (3.25 mm) minimum thickness impact resistant injection molded acrylic classified as CC2 material; UV inhibiting, impact modified acrylic blend.
b. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
c. LightTracker Reflector: Aluminum sheet, thickness 0.015 inch (0.4 mm) with Spectralight Infinity. Positioned in dome to capture low angle sunlight.

2. Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.

a. Base Material: Sheet steel, corrosion resistant, meeting ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch (0.7 mm) thick.
b. Base Style: Type FCM, Curb cap, with inside dimensions of 27 inches by 27 inches (685 mm x 685 mm) to cover curb as specified in Section 07 60 00.
c. Dome Edge Protection Band: Type PB, For fire rated roofs. Aluminized steel. Nominal thickness of 0.028 inches (0.7 mm).

3. Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact acrylic; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
4. Reflective Extension Tube: Aluminum sheet, thickness 0.015 inch (0.4 mm).

a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 93 percent.
b. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
c. Tube Diameter: Approximately 14 inches (356 mm).

5. Reflective 30 degree Adjustable tube: Aluminum sheet, thickness .015 inch (0.4 mm)

a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 93 percent.

6. Ceiling Ring: Injection molded impact resistant acrylic. Nominal thickness is 0.110 inches (2.8 mm).

7. Dual Glazed Diffuser Assembly:

a. Upper glazing: Acrylic plastic classified as CC2 material. The nominal thickness is 0.040 inches (1.020 mm).
b. Lower glazing (Optiview Fresnel Lens): Molded polycarbonate plastic classified as CC1 material. The nominal thickness is 0.022 inches (0.61 mm).
c. Diffuser Trim Ring: Injection molded acrylic.

1) Stainless-tone Trim (Optiview Fresnel Lens): Type L5.

8. Catalog Number: 290 DS-DA-FCM-L5- PB

2.3. ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injected molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

3. EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until substrates have been properly prepared.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s printed instructions.

B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, and Project Inspector. Correct if needed before proceeding with installation of subsequent units.

3.3 PROTECTION:

A. Protect installed products until completion of project. Touch-up or repair/replace damaged units at substantial completion.

**END OF SECTION 08 62 00**

# SECTION 08 71 00 – FINISH HARDWARE

1. GENERAL:

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Definition: "Finish Hardware" includes items known commercially as builders hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame. Types of items in this section include (but are not necessarily limited to):

Hinges
Lock Cylinders and Keys
Lock and latch sets
Bolts
Exit devices (panic hardware)
Push/pull units
Closers
Overhead holders
Miscellaneous door control devices
Door trim units
Protection plates
Thresholds
Weather-stripping

B. "Hardware groups" have been assigned to the various doors required for this Work, as described in the Door Schedule on the Drawings; the hardware groups are described in detail in this Section of these Specifications.

1.3 QUALITY ASSURANCE:

A. Manufacturer: Obtain each kind of hardware (latch and locksets, hinges, closers, etc) from only one manufacturer.

B. Supplier: A recognized builders hardware supplier who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or employs an experienced hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to owner, Architect and Contractor.

C. Fire-rated Openings: Provide hardware for fire-rated openings in compliance with UL10B. Provide only hardware which has been tested and listed by UL for types and sizes of doors required and complies with requirements for door and door frame labels. In addition manual locks shall comply with California State Standards (CSS) 12-33-2 and panic hardware shall comply with CSS 12-33-3.

Where emergency exit devices are required on fire-rated doors, provide supplementary marking on doors UL labels indicating "Fire Exit Hardware."

D. Accessibility Requirements: For door hardware on doors required to be accessible, comply with applicable provisions in CCR Title 24, Part 2, California Building Code – Accessibility Standards as enforced by DSA.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 pounds.

2. Comply with the following maximum opening-force requirements:

   a. Interior, Non-Fire-Rated Hinged Doors: 5 pounds applied perpendicular to door.

   b. Exterior, Non-Fire-Rated Hinged Doors: 5 pounds applied perpendicular to door.

   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction to achieve positive latching, but not exceeding 15 pounds maximum.

3. Thresholds: The floor or landing shall not be more than ½ inch lower than the threshold of the doorway. Change in level between ¼ inch and ½ inch shall be beveled with a slope no greater than one unit vertical in two units horizontal (50 percent slope.

4. Adjust door closers sweep periods (Delayed Action Feature) so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum, measured to the leading edge of the door.

E. Hardware Coordination Meeting: During the course of the work but prior to ordering; contractor shall hold a meeting to review specific door hardware. This meeting shall review the hardware and key schedule along with specific information concerning location and function of each lockset. The meeting shall include the Architect, District Representative, District Locksmiths, General Contractor, Hardware Sub-contractor, and the manufacturer's representative.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical information for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule: Submit final hardware schedule confirming compliance as indicated herein. Hardware schedules are intended for coordination of work. Include the following:

1. Name and manufacturer of each item.

2. Fastenings and other pertinent information

3. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

4. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.

5. Mounting locations for hardware.

6. Door and frame sizes and materials.

7. Keying information.

1.5 PRODUCT HANDLING:

A. Packaging:

1. Furnish all finish hardware with each unit clearly marked or numbered in accordance with the Hardware Schedule.

2. Pack each item complete with all necessary pieces and fastener.

3. Properly wrap and cushion each item to prevent scratches during delivery and storage.

B. Delivery:

1. Deliver all finish hardware to the installers in a timely manner to ensure orderly progress of the total work.

2. PRODUCTS

2.1 FASTENINGS:

A. General:

1. Furnish all finish hardware with all necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use.

2. Furnish fastenings where necessary with expansion shields, toggle bolts, sex bolts, and other anchors approved by the Architect, according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer.

3. Provide the products of the manufacturers listed, without substitutions, unless approved in advance, in writing, by Architect.

B. Design:

1. All fastenings shall harmonize with the hardware as to material and finish.

2.2 KEYING:

A. Construction Keying: Provide a method independent of the final keying system for securing the building during construction. Contractor must supply Schlage construction cylinders.

B. Final Keying System:

Schlage Primus System, Security Level Three, Type EP keyways using 20-700 controlled access cylinders as determined by District. Provide Interchangeable Cores (IC) at all panic devices and where called for in the hardware schedule. All cylinders/IC cores shall be provided to District, by hardware supplier at the time of delivery of the locks. Cylinders/IC Cores shall be Master keyed by District's Hardware Department, using Schlage Primus System. After Keying, all cylinders/IC cores shall be issued back to the General Contractor for installation. This requires a coordination meeting with the GC, Hardware Supplier, Schlage Representative, District Locksmith, and Architect, to be scheduled by the GC within 3 weeks of the Notice to Proceed.

C. Key Blanks:

Standard 6 pin bow key blank; tag to identify

1. Supply 20 Emergency Keys
2. Supply 500 EP Primus Blanks; one side embossed

2.3 FINISH:

A. All finishes to be satin chromium plated, US 26 D, ANSI 626 unless otherwise indicated.

2.4 HARDWARE:

**FOR THE 100% CD/DSA SUBMITTAL THE HARDWARE WILL BE SPECIFIED AND SCHEDULED ON THE DRAWINGS. BELOW IS A LIST OF THE PROPOSED HARDWARE.**

A. Locks/Latchsets (All knobs are lever-type: L Design (Sargent), Rhodes (Schlage), Newport (Corbin Russwin.) Rose: L Design (Sargent.)

#1 Panic, Corbin Russwin (Storefront Double Doors), ED4200S x P1057 (Nightlatch function, Offset Pull P10) x M52 (cylinder dogging) x ED4200S x P1050 (Dummy Trim, Offset Pull P10) x 52 (cylinder dogging) x 808 (Removable Mullion with Aluminum Finish to match door color) with Schlage 20-757 (IC) Rim and Dogging Cylinders. Panic Device to receive BHMA 613 Dark Oxidized Satin Bronze. Trims to receive BHMA 626 Satin Chromium Plated Finish.

#2 Panic, Corbin Russwin (Double Doors), ED8200 x P857 (Nightlatch function, Wing Pull P8) x M54 (sex nuts & bolts) x ED8200 x P850 (Dummy Trim, Wing Pull P8) x 54 (sex nuts & bolts). Provide Von Duprin KR4954 x 154 x Angle Plate (Keyed Removable Mullion with Mullion Stabilizer. Provide Corbin Russwin Strikes). Provide Schlage 20-757 (IC) Rim and Removable Mullion Cylinders. Panic Device and Trims to receive BHMA 689 Silver Painted Finish.

#3 Panic, Corbin Russwin, ED8200 x P857 (Nightlatch function, Wing Pull P8) x M54 (sex nuts & bolts) with Schlage 20-757(IC) Rim Cylinder. Panic Device and Trims to receive BHMA 689 Silver Painted Finish.

#4 Panic, Corbin Russwin ED5202SA (fire rated) x N955 (SecureBolt Double Cylinder Classroom Function, Newport Lever N9) x M54 (sex nuts & bolts) with Schlage 20-757 (IC) Rim Cylinder (both sides). Panic Device and Trims to receive BHMA 626 Satin Plated Chromium Plated Finish

#5 Storeroom Lock, Sargent 28-30-11G04-LL. (LL designates L Design for Lever and Rose). Provide Schlage 20-765 Primus Cylinder.

#6 Classroom Security, Sargent 28-30-11G38-LL. Provide Schlage 20-765 Primus Cylinder.

#7 Office, Sargent 28-30-11G05-LL. Provide Schlage 20-765 Primus Cylinder.

#8 Staff Toilets, Schlage, ND85LD, Rhodes. Provide Schlage 20-765 Primus Cylinder.

#9 Student/Public Toilets, Sargent 28-11U15-LL

#10 Roll-up Door Cylinder. Provide Schlage 20-765 Primus Cylinder.

B. Hinges

#1 HAGER, BB1199 Stainless, 4 ½ x 4 ½, Heavy Weight, High Frequency, Five-knuckle, four bearing, NRP, full-mortise butts, 1 ½ pair.

#2 HAGER, BB1199 Stainless, 4 ½ x 4 ½, Heavy Weight, High Frequency, Five-knuckle, NRP, four bearing, full-mortise butts, 2 pair.

C. Closers

#1 NORTON, PR7500DA (Barrier Free, 90 degree opening with delayed closing, Painted Aluminum)

#2 NORTON, PR7500DA (Barrier Free, 180 degree opening with delayed closing, Painted Aluminum)

D. Stops

#1 Trimco, #1270CVSV – Stop, Wall

#2 Trimco, #1209 – Stop, Floor (Interior)

#3 Trimco, #1209HA – Stop, Walk (Exterior)

E. Thresholds

#1 Threshold, Pemko; 158 A (1/2" offset)

#2 Threshold, Pemko; 272 A (6")

#4 Threshold, Pemko; 2005-T (1/2" latching panic saddle)

F. Miscellaneous

#1 Lock Guard, BLP 107-630 3-1/4"x7" Latch Protection

#2 Kick Plate, Quality, 10", .050", Aluminum

#3 Weather-strip, Pemko, 319 CR

#4 Smoke Seal, Pemko, HSS2000xS88

#5 Shoe, Pemko; 217AV (sweep)

3. EXECUTION:

3.1 DELIVERIES:

Stockpile all items sufficiently in advance to ensure their availability and make all necessary deliveries in a timely manner to ensure orderly progress of the total work.

3.2 INSTALLATION:

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect. Hand-activated hardware such as lever latchsets, panic bars, push-pull handles, and lever handle thumb-turn dead bolts shall be mounted between 30" to 44" above finish floor.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fittings required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation. **Provide steel stud backing in walls as necessary to provide proper anchorage for wall mounted hardware.**

D. Drill and countersink units, which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.3 ADJUST AND CLEAN:

A. Adjust and check each operating item of hardware and each door, to ensure proper operation of function of every unit. Replace units, which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

C. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware, and deliver report to owner with a copy to the Architect.

**END OF SECTION**

# SECTION **08 80 00** - **GLAZING**

## 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 for windows, doors, and interior borrowed lites.
2. Glazing gaskets and accessories.

B. Related Requirements:
1. Section 08 88 59 "Thermochromic Glass."

### 1.3 DEFINITIONS

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

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. CBC: 2016 California Building Code.

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

### 1.4 COORDINATION

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

### 1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches square.
1. Laminated glass.
2. Insulating glass.

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

D. Product Certificates: For glass.

E. Product Test Reports: For tinted glass and insulating glass, for tests performed by a qualified testing agency.

F. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. PPG Industries, Inc.
      b. Guardian Industries Corp.; SunGuard.
      c. Pilkington North America.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
   1. Obtain tinted glass from single source from single manufacturer.
   2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Conform to CCR Title 24, Part 2, California Building Code, Chapter 24. Safety Glass shall conform to CCR Title 24, Part 2, California Building Code, Section 2406 and shall be tested in accordance to CPSC 16 CFR 1201. Glazing shall comply with the test criteria for Category I or II as indicated in Table 2406.2(1). Glazing that is not installed in doors are permitted to be tested in accordance with ANSI Z97.1. Under ANSI Z97.1, glazing shall comply with the test criteria for Class A or B as indicated in Table 2406.2(2)

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 7.3 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 7.3 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is required per CCR Title 24, Part 2, California Building Code, Section 2406.3, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength:. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

B. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type GL-1: Clear, fully tempered float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

B. Glass Type GL-4: Tinted laminated glass with two plies of heat-strengthened float glass with outer ply tinted and inner ply clear.
   1. Basis-of-Design Product: PPG Industries, Inc.; Solarbronze and Clear Glass.
   2. Tint Color: Bronze.
   3. Minimum Thickness of Each Glass Ply: 3 mm.
   4. Interlayer Thickness: 0.030 inch.
   5. Winter Nighttime U-Factor: 1.00 maximum.
   6. Visible Light Transmittance: 66 percent minimum.

7. Solar Heat Gain Coefficient: 0.67 maximum.
8. Safety glazing required.

C. Glass Type GL-4B (Alternate – North Elevation): Clear laminated glass with two plies of heat-strengthened float glass with outer ply tinted and inner ply clear.
1. Basis-of-Design Product: PPG Industries, Inc.; Clear Glass.
2. Minimum Thickness of Each Glass Ply: 3 mm.
3. Interlayer Thickness: 0.030 inch.
4. Winter Nighttime U-Factor: 1.00 maximum.
5. Visible Light Transmittance: 88 percent minimum.
6. Solar Heat Gain Coefficient: 0.78 maximum.
7. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE

A. Glass Type GL-6: Low-E-coated, tinted, insulating laminated glass.
1. Basis-of-Design Product: PPG Industries, Inc.; Solarbronze and Solarban 60 Solar Control Low-E Glass.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Outdoor Lite: 6 mm.
4. Outdoor Lite: Tinted fully tempered float glass.
5. Tint Color: Bronze.
6. Interspace Content: Air.
7. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
   a. Minimum Thickness of Each Glass Ply: 3 mm.
   b. Interlayer Thickness: 0.030 inch.
8. Low-E Coating: Sputtered on third surface.
9. Winter Nighttime U-Factor: 0.29 maximum.
10. Visible Light Transmittance: 42 percent minimum.
11. Solar Heat Gain Coefficient: 0.32 maximum.
12. Safety glazing required.

B. Glass Type GL-6B (Alternate – North Elevation): Low-E-coated, clear, insulating laminated glass.
1. Basis-of-Design Product: PPG Industries, Inc.; Clear and Solarban 60 Solar Control Low-E Glass.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Outdoor Lite: 6 mm.
4. Outdoor Lite: Clear fully tempered float glass.
5. Interspace Content: Air.
6. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
   a. Minimum Thickness of Each Glass Ply: 3 mm.
   b. Interlayer Thickness: 0.030 inch.
7. Low-E Coating: Sputtered on third surface.
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Visible Light Transmittance: 70 percent minimum.
10. Solar Heat Gain Coefficient: 0.46 maximum.
11. Safety glazing required.

END OF SECTION 08 80 00

# SECTION 08 83 00 - MIRRORS

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 the following types of silvered flat glass mirrors:

1. Tempered glass mirrors qualifying as safety glazing.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. California Green Building Standards Code (GBC) Submittals:

1. Product Data: For mirror mastic, documentation indicating that products:

a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2013 California Green Building Standards Code).
b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.

2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):

a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

D. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

E. Qualification Data: For Installer.

F. Product Certificates: For each type of mirror and mirror mastic.

G. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

H. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

B. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.

1. Nominal Thickness: 6.0 mm.

B. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Adhesive shall have a VOC content of 50 g/L or less.

2.4 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
3. Finish: Clear bright anodized.

B. Fasteners: Stainless Steel Fasteners as called for on approved drawings.

2.5 FABRICATION

A. Fabricate mirrors in the shop to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:

a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 83 00

# SECTION **08 88 13** - **FIRE-RESISTANT GLAZING**

## 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. Fire-protection-rated glazing.

### 1.3 DEFINITIONS

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

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

### 1.4 COORDINATION

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

### 1.5 SUBMITTALS

A. Product Data: For each type of product.

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For sealants, sealant primers, and caulks, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of sealant, sealant primer, or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Glass Samples: For each type of glass product; 12 inches square.

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

E. Qualification Data: For installers and glass testing agency.

F. Product Certificates: For each type of glass and glazing product, from manufacturer.

G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Double Glazing Units with Clear Gel Fill: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of double glazing units with clear gel fill is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is the leakage of gel fill from units, air bubbles within units, or obstruction of vision by contamination or deterioration of gel.
   1. Warranty Period: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing labeling is required per CCR Title 24, Part 2, California Building Code, Section 2406.3, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
   1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.

C. Film-Faced Polished Wired Glass (**FPGL-2**): ASTM C 1036, Type II, Class 1 (clear), Form 1, Quality-Q6 and complying with testing requirements in 16 CFR 1201 for Category II materials.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide **SaftiFIRST; SuperLite I-W (45 minute fire rated)** or comparable product by one of the following:
      a. TGP; WireLite NT
   2. Mesh: M2 (square).

2.5 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
   1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 FIRE-PROTECTION-RATED GLAZING SCHEDULE

A. Glass Type **FPGL-2**: 45-minute fire-protection-rated glazing; wire glass with surface applied safety film.

END OF SECTION 08 88 13

# SECTION **08 88 59** – **THERMOCHROMIC GLASS (ALTERNATE)**

## 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. Thermochromic glass for exterior windows and doors.

B. Related Requirements:
   1. Section 08 80 00 "Glazing."

### 1.3 DEFINITIONS

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

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. CBC: 2016 California Building Code.

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

### 1.4 COORDINATION

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

### 1.5 SUBMITTALS

A. Product Data: Description data and performance attributes for thermochromic glass, including:

B. 1. Preparation instructions and recommendations.

C. 2. Storage and handling requirements and recommendations.

D. 3. Installation methods.

E. Glass Samples: For each finish product specified, two 12 inch square thermochromic glass samples.

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

G. Product Certificates: For glass.

H. Product Test Reports: For tinted glass and insulating glass, for tests performed by a qualified testing agency.

I. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years experience manufacturing similar products.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Thermochromic Glass: 10 year warranty from date of Substantial Completion providing for replacement of glass units exhibiting filter delamination from glass, optical failures including bubbles, and heat seal failure, not including labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Raven Window
   b. Architect and District approved equal.

2.2 SOLAR FILTER

A. RavenWindow Thermochromic filter, applied to glass surface No. 2.

B. Performance Characteristics:
1. Heat and ultraviolet exposure: Pass 216 hour exposure under 700 watt UV curing lamp at sample temperature of 90 degrees C.
2. Vibration and flexure: No defects, tested for 24 hours between two speakers set to 90 db and using tone generating software generating sounds from 20 to 20,000 Hz in 4 second cycles.
3. Solar: No change to visual of functional conditions, tested to ASTM E2141.
4. Fogging: No visual fogging, tested to ASTM E2189.

5. Heat/Humidity and thermal cycling: No damage to filter or visible change in appearance or function, tested to ASTM E2188.
6. Long term cycling: No damage to filter or visible change in appearance or function, tested to ASTM E2190.

2.3 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Conform to CCR Title 24, Part 2, California Building Code, Chapter 24. Safety Glass shall conform to CCR Title 24, Part 2, California Building Code, Section 2406 and shall be tested in accordance to CPSC 16 CFR 1201. Glazing shall comply with the test criteria for Category I or II as indicated in Table 2406.2(1). Glazing that is not installed in doors are permitted to be tested in accordance with ANSI Z97.1. Under ANSI Z97.1, glazing shall comply with the test criteria for Class A or B as indicated in Table 2406.2(2)

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 7.3 computer program, expressed as Btu/sq. ft. x h x deg F.
3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 7.3 computer program.
4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is required per CCR Title 24, Part 2, California Building Code, Section 2406.3, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

E. Strength:. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.5 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

B. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Class 1 (clear), Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.6 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Clear unless otherwise indicated.

2.7 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   2. Spacer: Manufacturer's standard spacer material and construction.
   3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.8 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type GL-4A (East, South, and West Elevations): Clear laminated glass with two plies of heat-strengthened float glass with outer ply tinted and inner ply clear.
   1. Basis-of-Design Product: PPG Industries, Inc.; Clear Glass.
   2. Solar Filter: RavenWindow; Thermochromic Filter, applied to glass surface No. 2.
   3. Minimum Thickness of Each Glass Ply: 3 mm.
   4. Interlayer Thickness: 0.030 inch.
   5. Winter Nighttime U-Factor: 1.00 maximum.
   6. Visible Light Transmittance (Clear): 88 percent minimum.
   7. Visible Light Transmittance (Full Tint): 6 percent
   8. Solar Heat Gain Coefficient (Clear): 0.78.
   9. Solar Heat Gain Coefficient (Full Tint): 0.63.
   10. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE

A. Glass Type GL-6A (East, South, and West Elevations): Low-E-coated, tinted, insulating laminated glass.
   1. Basis-of-Design Product: PPG Industries, Inc.; Clear and Solarban 60 Solar Control Low-E Glass.
   2. Solar Filter: RavenWindow; Thermochromic Filter, applied to glass surface No. 2.
   3. Overall Unit Thickness: 1 inch.
   4. Minimum Thickness of Outdoor Lite: 6 mm.
   5. Outdoor Lite: Clear fully tempered float glass.
   6. Interspace Content: Air.
   7. Indoor Lite: Clear laminated glass with two plies of heat-strengthened float glass.
      a. Minimum Thickness of Each Glass Ply: 3 mm.
      b. Interlayer Thickness: 0.030 inch.
   8. Low-E Coating: Sputtered on third surface.
   9. Winter Nighttime U-Factor: 0.29 maximum.
   10. Visible Light Transmittance (Clear): 34 percent minimum.
   11. Visible Light Transmittance (Full Tint): 5 percent
   12. Solar Heat Gain Coefficient (Clear): 0.46.
   13. Solar Heat Gain Coefficient (Full Tint): 0.36.
   14. Safety glazing required.

END OF SECTION 08 88 59

# SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Fixed extruded-aluminum louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Sample Warranties: For manufacturer's special warranties.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide **Ruskin Company; EME520DD** or a comparable product by one of the following:
      a. Air Balance; a division of MESTEK, Inc.
      b. Air Flow Company, Inc.
      c. Airline Louvers; a division of Mestek, Inc.
      d. Airolite Company, LLC (The).
      e. All-Lite Architectural Products.
      f. Arrow United Industries.
      g. Construction Specialties, Inc.
      h. Greenheck Fan Corporation.
      i. Industrial Louvers Inc.
      j. NCA Manufacturing, Inc.
      k. Pottorff.
      l. Reliable Products, Inc.
      m. United Enertech.
   2. Louver Depth: 5 inches.
   3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
   4. Louver Performance Ratings:
      a. Free Area: Not less than 7.59 sq. ft. for 48-inch-wide by 48-inch-high louver.
      b. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area exhaust velocity.
      c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 400 fpm.
   5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
   2. Finish: Mill finish unless otherwise indicated.
   3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Aluminum, 18-by-16 mesh, 0.011-inch wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, 300 series stainless-steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide subsills made of same material as louvers or extended sills for recessed louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

**END OF SECTION 08 91 19**

# SECTION 09 21 16.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

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. Gypsum board shaft wall assemblies.
2. One hour corridor ceiling assemblies

1.3 SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall and corridor ceiling assemblies.

B. California Green Building Standards Code Submittals:
1. Laboratory Test Reports: For gypsum board shaft wall systems, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Evaluation Reports: For shaft wall and ceiling assemblies, from ICC-ES or other DSA recognized evaluation service (**DSA IR-A5**).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements, provide USG (United States Gypsum Company); Shaft Wall and Ceiling System (PEI ES AER-09038 – Dated October 2016).

B. A substitution of the above Basis-of-Design Product requires DSA approval before acceptance by the architect and the school district. The cost for obtaining DSA approval shall be at no additional cost to the school district.

2.3 GYPSUM BOARD SHAFT WALL ASSEMBLIES (**FR3**)

A. Fire-Resistance Rating: 1 hour.

B. STC Rating: 51, minimum.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
   1. Depth: 2-1/2 inches, 4 inches & 6 inches (See approved drawings for size).
   2. Minimum Base-Metal Thickness: 0.033 inch (20 gauge).

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
   1. Minimum Base-Metal Thickness: 0.033 inch (20 gauge).

E. Room-Side Finish: Gypsum board, Type X.

F. Shaft-Side Finish: Gypsum shaftliner board, Type X.

G. Insulation: Sound attenuation blankets.

2.4 ONE HOUR CORRIDOR CEILING ASSEMBLIES (**FR2**)

A. Fire-Resistance Rating: 1 hour.

B. Joists: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
   1. Depth: 4 inches.
   2. Minimum Base-Metal Thickness: 0.033 inch (20 gauge).

C. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
   1. Minimum Base-Metal Thickness: 0.033 inch (20 gauge).

D. Room-Side Finish: Gypsum board, Type X.

E. Shaft-Side Finish: Gypsum shaftliner board, Type X.

F. Insulation: Sound attenuation blankets.

2.5 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
   1. Thickness: 1 inch.
   2. Long Edges: Double bevel.

C. Gypsum Board: As specified in Section 09 29 00 "Gypsum Board."

2.6 NON-LOAD-BEARING STEEL FRAMING

A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40unless otherwise indicated.

B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Expansion Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to 2013 CBC, section 1908A or 1909A; ICC-ES AC193 and ACI 318-08 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.

E. Power-Actuated Anchors: Current ICC-ES evaluation report or other acceptable evaluation report meeting the requirements of DSA IR A-5. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

F. Sound Attenuation Blankets: As specified in Section 09 29 00 "Gypsum Board."

G. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

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

3.2 INSTALLATION

A. General: Install gypsum board shaft wall and corridor ceiling assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall and corridor ceiling assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

D. Penetrations: At penetrations in shaft wall and corridor ceiling, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints at locations indicated on Drawings while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 09 21 16.23**

# SECTION **09 24 00** - **PORTLAND CEMENT PLASTERING**

## 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. Exterior portland cement plasterwork (stucco) on metal lath.

B. Related Sections:
   1. Section 05 40 00 "Cold-Formed Metal Framing."
   2. Section 06 10 00 "Rough Carpentry" for wood framing and furring included in portland cement plaster assemblies.
   3. Section 06 16 00 "Sheathing" for sheathing included in portland cement plaster assemblies.
   4. Section 07 21 00 "Thermal Insulation" for thermal insulations included in portland cement plaster assemblies.
   5. Section 07 27 26 “Fluid Applied Membrane Air Barriers.”

### 1.3 SUBMITTALS

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

B. Samples for Verification: For each type of colored and textured finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

### 1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Mockups: Before plastering, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for each type of finish indicated.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Technical Evaluation Reports: For attachment of metal lath through foam plastic insulating sheathing (FBIS) to wood and metal stud framing, comply with requirements of TER No. 1303-04 and per the requirements indicated in these specifications and as shown on the drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F for at least 48 hours before plaster application, and continuously during and after application.
   1. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
   2. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

C. Exterior Plasterwork:
   1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
   2. Apply plaster when ambient temperature is greater than 40 deg F.
   3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

D. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. CEMCO.
      b. Western Metal Lath.
      c. Dietrich Metal Framing; a Worthington Industries company.
   2. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd..
   3. 3/8-Inch Rib Lath: 3.4 lb/sq. yd.

B. Wire-Fabric Lath:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Structa Wire Corp.; Structalath Twin Trac (ICC #ESR 2017)
      b. Architect and District Approved Equal.
   2. Welded-Wire Lath: ASTM C 933; self-furring, 1.14 lb/sq. yd.

C. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper.
   1. Provide paper-backed lath at exterior locations.

## 2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CEMCO.
   b. Clark Western Building Systems.
   c. Dietrich Metal Framing; a Worthington Industries company.
   d. Stockton Products
   e. Western Metal Lath
2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653, G60 zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A 653, G60, hot-dip galvanized zinc coating.
4. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
   a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
   b. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
5. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
8. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.
9. Soffit Vent: Fabricated from zinc-coated (galvanized) steel; formed to provide a vent with 1/8” vent holes; with expanded or solid flanges. Size as shown on drawings.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fry Reglet Corp.
   b. Gordon, Inc.
   c. Pittcon Industries.
   d. Stockton Products.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Clear Anodic Finish; AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## 2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: ASTM C 1116, alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 954, #10 self-drilling, self-tapping; with ¾ inch (min.) diameter pan head that is suitable for application; in lengths required to achieve penetration through joined materials and metal stud flange by no fewer than three exposed threads or 3/8 inch (whichever is greater) and shall engage not less than three strands of lath.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
   1. Nails for attaching metal lath to wood stud framing shall have a 0.162" diameter head and shall be in lengths required to achieve penetration through joined materials and into wood stud framing by no less than 1 ¼ inches.

F. Wire: ASTM A 641, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

## 2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

C. Sand Aggregate: ASTM C 897.

D. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Bonsal American, an Oldcastle Company; Marblesil Stucco Mix.
      b. California Stucco Products Corp.; Conventional Portland Cement Stucco.
      c. Florida Stucco; Florida Stucco.
      d. LaHabra, a brand of ParexLaHabra, Inc.; Exterior Stucco Color Coat.
      e. Omega Products International, Inc.; ColorTek Exterior Stucco.
      f. QUIKCRETE; QUIKCRETE Finish Coat Stucco, No. 1201.
      g. Shamrock Stucco LLC; Exterior Stucco.
   2. Color: Match exterior paint colors.

## 2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.
   1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
   1. Portland Cement Mixes:
      a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
      b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters, comply with manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

### 3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

### 3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

### 3.4 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063, TER No. 1303-04 (when attaching metal lath to wood or metal stud framing over Foam Plastic Insulating Sheathing) and 2016 CBC Section 2603.12.
   1. Flat-Ceiling and Horizontal Framing: Install 3/8-inch rib lath.
   2. On Solid Surfaces, Not Otherwise Furred: Install self-furring, expanded metal or welded-wire lath.

B. Attach lath to metal and wood framing with screws at 6 inches on center along framing supports.

### 3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:
   1. Install cornerbead at exterior locations.

C. Control Joints: Install control joints at locations indicated on Drawings and per the following minimum requirements:
   1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
      a. Vertical Surfaces: 144 sq. ft..

b. Horizontal and other Nonvertical Surfaces: 100 sq. ft..
2. At distances between control joints of not greater than 18 feet o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

D. Aluminum Trim: Install at locations indicated on Drawings.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C 926, TER No. 1303-04, and 2016 CBC 2603.12.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
4. When attaching metal lath to metal stud framing over Foam Plastic Insulating Sheathing, the weight of the plaster assembly shall not exceed the limits set forth in table 1a of TER No. 1303-04 and 2016 CBC Table 2603.12.1. For installation of exterior cement plaster over 1 ½" thick foam insulation, the weight of the plaster assembly shall not exceed 25 psf.

B. Bonding Compound: Apply on concrete plaster bases.

C. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4-inch thickness.
1. Portland cement mixes.

D. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4-inch thickness.
1. Portland cement mixes.

E. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch thick (minimum) on concrete masonry.
1. Portland cement mixes.

F. Plaster Finish Coats: Apply to provide float finish.

G. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.

H. Concealed Interior Plasterwork:
1. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
2. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
3. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

**END OF SECTION 09 24 00**

# SECTION **09 29 00.A5** - **SHEATHING**

## 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. Wall sheathing.
   2. Parapet Wall Sheathing (To receive roofing material)

B. Related Requirements:
   1. Section 07 27 26 "Fluid-Applied Membrane Air-Barriers" for vapor-permeable membrane air barriers applied over wall sheathing.

### 1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory," GA-600, "Fire Resistance Design Manual, or Chapter 7 of CCR Title 24, Part 2, California Building Code.

### 2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. G-P Gypsum Corporation; Dens-Glass Gold.
b. United States Gypsum Co.; Securock.
c. CertainTeed Corporation; GlasRoc.
d. National Gypsum Company; Gold Bond e(2)XP.
e. Temple-Inland Inc.; GreenGlass

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 96 inches, 48 by 108 inches, or 48 by 120 inches for vertical installation as required for coordination with framing.

2.3 PARAPET WALL SHEATHING

A. Glass-Mat, Water-Resistant Gypsum Substrate Board: ASTM C 1177.
1. Products: Subject to compliance with requirements, provide the following:
a. G-P Gypsum Corporation; DensDeck Prime.
b. Or District and Architect “approved equal”.
2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 48 inches or 48 by 96 inches, for vertical installation as a liner for roof side of parapet walls.

2.4 FASTENERS

A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length necessary to achieve penetration through metal stud flange of no fewer than 3 exposed threads or 3/8 inch (whichever is greater), with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.
a. Size: #6-20 x 1 ¼ inch (minimum)
b. Head Type: #2 Phillips drive, bugle-head.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions as submitted to and approved by Architect.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

**END OF SECTION 09 29 00.A5**

# SECTION **09 29 00** - **GYPSUM BOARD**

## 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. Interior gypsum board.
   2. Tile backing panels.
   3. Texture finishes.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For adhesives used to laminate gypsum board panels to substrates, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

### 1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturer’s recommended by prime manufacturers of gypsum board panels

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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."

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Georgia-Pacific Gypsum LLC.
   2. USG Corporation.
   3. American Gypsum.
   4. CertainTeed Corp.

5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.

B. Gypsum Board, Type X: ASTM C 1396.
1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
b. CertainTeed Corp.; GlasRoc Tile Backer.
2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

## 2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate (including concrete curbs).
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Grabber Construction Products; GDWAF – Drywall Adhesive.
      b. W. W. Henry Company; Henry 317 Multipurpose Construction Adhesive.
      c. Henkel Corporation; OSI F-38 – Drywall Adhesive

C. Steel Drill Screws: ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick. Screw shall be of sufficient length to achieve penetration through metal stud flange by no fewer than 3 exposed threads or 3/8 inch (whichever is greater.)
   1. Size: #6 x 1 ¼ inch (minimum).
   2. Head type: #2 Phillips drive, bugle-head.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Acoustical joint 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."

F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

## 2.8 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
      a. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.
      b. CertainTeed Corp.; ProRoc Easi-Tex Spray Texture.
      c. National Gypsum Company; Perfect Spray EM Texture.
   2. Texture: Orange Peel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

## 3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: All surfaces unless otherwise indicated.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws. Unless otherwise noted on the approved drawings, screws shall be spaced not more than 12 inches o.c. for ceilings and 16 inches o.c. for walls where framing members are 16 inches o.c. Screws shall be spaced not more than 12 inches o.c. for both ceilings and walls where the framing members are 24 inches o.c. Refer to approved drawings for alternative screw spacing at fire rated assemblies.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers and face layers separately to supports with screws. Unless otherwise noted on the approved drawings, for the base layer, screws shall be spaced not more than 24 inches on center for both walls and ceilings for framing at both 16 inches and 24 inches on center. Unless otherwise noted on the approved drawings, for the face layer, screws shall be spaced not more than 12 inches o.c. for ceilings and 16 inches o.c. for walls where framing members are 16 inches o.c. Screws shall be spaced not more than 12 inches o.c. for both ceilings and walls where the framing members are 24 inches o.c. Refer to approved drawings for alternative screw spacing for the base and face layers at fire rated assemblies.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board and laminating adhesive manufacturers' written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

## 3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

## 3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. Bullnose Bead: Use where indicated.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. U-Bead: Use where indicated.
   6. Curved-Edge Cornerbead: Use at curved openings.

## 3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and under VFTW.
   2. Level 2: Panels that are substrate for tile, acoustical panels, and under FRP.
   3. Level 4: At panel surfaces that will be exposed to view. These walls and ceilings will receive an “Orange Peel” texture.
      a. Primer and its application to surfaces are specified in Section 09 91 00 "Painting and Finishing."

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

## 3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 09 29 00**

# SECTION **09 30 00** – **TILE**

## 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. Ceramic tile.
2. Metal edge strips.
3. Grout.

B. Related Sections:
1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for glass-mat, water-resistant backer board.

### 1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.5, and ANSI A108.10, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

### 1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
1. Level Surfaces: Minimum 0.6 Wet.
2. Step Treads: Minimum 0.6 Wet.
3. Ramp Surfaces: Minimum 0.8 Wet.

### 1.5 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:

1. Product Data: For adhesives, sealants and caulks, documentation indicating that products:
   a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.4.2 (2016 California Green Building Standards Code).
   b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
2. Product Data: For aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
   a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.
3. Product Data: For tile flooring systems, documentation indicating that products:
   a. 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. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Full-size units of each type of trim and accessory for each color and finish required.
   3. Metal edge strips in 6-inch lengths.

D. Qualification Data: For qualified Installer.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicate where materials were delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

## 1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of floor tile installation.
   2. Build mockup of each type of wall tile installation.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site.
1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Low-Emitting Materials: Tile flooring systems 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. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## 2.2 TILE PRODUCTS

A. Tile Type (CT-1): Factory-mounted unglazed ceramic mosaic floor tile.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Olean; Division of Dal-Tile International Inc.
   b. Daltile; Division of Dal-Tile International Inc.
2. Composition: Vitreous or impervious natural clay or porcelain.
3. Module Size: 2 by 2 inches.
4. Thickness: 1/4 inch.
5. Face: Pattern of design indicated, with cushion edges.
6. Surface: Slip-resistant, with abrasive admixture.
7. Finish: Unglazed.
8. Tile Color and Pattern: Equal to Dal Tile D204, Artisan Brown Speckle.
9. Grout Color: StarQuartz #290, Chestnut.

B. Tile Type (CT-2): Glazed wall tile.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Olean; Division of Dal-Tile International Inc.
   b. Daltile; Division of Dal-Tile International Inc.
2. Module Size: 4-1/4 by 4-1/4 inches.
3. Thickness: 5/16 inch.
4. Face: Plain with modified square edges or cushion edges.
5. Finish: Semi-Gloss glaze.
6. Tile Color and Pattern: Field Tile – Dal Tile O135, Almond. Accent Tile (Women and Girls' Toilets) Top and Bottom Row – Dal Tile O166, Elemental Tan. Center Row – Dal Tile K111, Black. Accent Tile (Men and Boys' Toilet) Top and Bottom Row – Dal Tile K111, Black. Center Row – Dal Tile O166 Elemental Tan. Refer to Interior Elevations for location of Accent Tile Band.
7. Grout Color: StarQuartz #145, Bone.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Base for Thin-Set Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches.
   b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches.
   c. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
   d. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

## 2.3 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
   1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
   2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
   1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
   1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
   2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

## 2.4 GROUT MATERIALS

A. Urethane Grout: Quartz based urethane grout, stainless, non-sagging, water cleanable; tested according ANSI A118.3 and 118.3 modified, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide QuartzLock2 urethane grout by StarQuartz Industries, Inc.
   2. Properties:
      a. Compressive Strength: 3,500 psi.
      b. Linear Shrinkage: 0.06 percent
      c. Water Absorption: <1 percent.

## 2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 07 92 00 "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

## 2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; white zinc alloy or stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series

"Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch.
   2. Glazed Wall Tile: 1/16 inch.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Provide vertical sealant-filled joints at interior corners of wall tile.
   3. Seal joint between perimeter of door frames and ceramic tile.

H. Metal Edge Strips: Install at locations indicated.

## 3.4 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION METHODS

A. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1C.
      a. Tile Type: CT-1.
      b. Thin-Set Mortar for Cured-Bed Method: Dry-set or Latex-portland cement mortar.
      c. Grout: Urethane grout.

B. Interior Wall Installations, Metal Studs or Furring:
   1. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCA W245.
      a. Tile Type: CT-2.
      b. Thin-Set Mortar: Latex-portland cement mortar.
      c. Grout: Urethane grout.

**END OF SECTION 09 30 00**

# SECTION **09 51 13** - **ACOUSTICAL PANEL CEILINGS**

## 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 acoustical panels and exposed suspension systems for ceilings.

B. Related Requirements:
   1. Section 07 92 19 “Acoustical Joint Sealants for sealing joints at acoustical panel ceilings.
   2. Section 09 51 23 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with adhesive bonding

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

C. Qualification Data: For Installer.

D. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicate where materials were delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 1 percent of quantity installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than three (3) years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer. Installer shall certify that they are familiar with requirements of DSA I.R. 25-2.13.

B. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including but not limited to light fixtures, HVAC equipment, fire suppression system components, gymnasium equipment, electrical, communication, and media devices and equipment, and partition systems.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design and install per ASTM C 635, ASTM C 636, and ASTM E 580, Section 5.

B. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and CCR Title 24, Part 2, California Building Code, Section 1616A.1.21.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings 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. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS: Keynote 09 51 00.A1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Cortega Second Look II #2767 or comparable product by one of the following:
   1. CertainTeed Corp.
   2. Chicago Metallic Corporation.
   3. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
   2. Pattern: CD (perforated, small holes and fissured).

C. Color: White.

D. LR: Not less than 0.82.

E. NRC: Not less than 0.55.

F. CAC: Not less 35.

G. Edge/Joint Detail: 15/16” Angled Tegular.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 48 inches.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635 ASTM C 636, ASTM E 580-Section 5, as amended by 2016 CBC Section 1616A.1.21.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements as detailed on Drawings and per DSA IR 25-2.13.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper and minimum tensile strength equal to 70 ksi.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch (#12 gage) diameter wire.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Compression struts designed to accommodate seismic forces. Compression post material and sizes are to be as detailed on the approved drawings.

2.5 METAL SUSPENSION SYSTEM

A. Approved Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Prelude XL (Main Beam #7301, Cross Runner #7340) – ICC-ES ESR-1308 or approved equal by one of the following:
1. Chicago Metallic Corporation. ICC-ES ESR-2631
2. USG Interiors, Inc.; Subsidiary of USG Corporation. ICC-ES ESR-1222

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted white.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Approved Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc. 2 inch wall molding or approved equal by one of the following:
1. Chicago Metallic Corporation.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard 2 inch deep edge moldings that fit acoustical panel edge details and suspension systems indicated and that match configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

### 3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and ASTM E 580, Section 5.2, DSA IR 25-2.13, and as detailed on the approved drawings.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system. Hanger wires that are more than 1 (horizontal) in 6 (vertical) out of plumb are to have counter-sloping wires.
2. 0.106 inch diameter (12 gauge) hanger wires may be used for up to and including 4 foot by 4 foot grid spacing and shall be attached to main runners.
3. Provide hanger wires at the ends of all main and cross runners within eight (8) inches of support or within one-fourth (1/4) of the length of the end tee, wires are not required when the length of the end tee is eight (8) inches or less.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Separate wall ceiling hanger wires at least six (6) inches from all unbraced ducts, pipes, conduits, etc.
6. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits, or discontinuous areas.

7. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Make all tight turns within a distance of 1-1/2 inches. Wire turns made be machine where both strands have been deformed or bent in wrapping can waive the 1-1/2 inch requirement, but the number of turns shall be maintained, and be as tight as possible. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures. Hanger wire anchors to the structure should be installed in such a manner that the direction of the anchor aligns with the direction of the wire.
8. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
9. When framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires. Attachment to metal deck is allowed as detailed on drawings.
10. Do not attach hangers to steel deck tabs.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members and metal deck as detailed on drawings.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings through substrate to steel stud framing at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members. Ceiling grid members shall be attached to two (2) adjacent walls per ASTM E580, Section 5.2.3. Ceiling grid members shall be at least ¾ inch clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main cross runners should be free, and a minimum of ¾ inch clear of wall. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between runners at the free end to prevent lateral spreading. A metal strut or a #16 gage wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 8” or less, this interlock is not required.

F. Provide lateral-force bracing assemblies consisting of a compression strut and four (4) #12 gage splayed bracing wires oriented 90 degrees from each other.
1. Locate lateral-force bracing assemblies as shown on the drawings but shall not be spaced greater than 12 feet by 12 feet on centers and no more than 6 feet from perimeter walls and at the edges of any change in elevation of the ceiling.
2. Fasten bracing wires with four (4) tight turns. Make all tight turns within a distance of 1-1/2 inches. Wire turns made be machine where both strands have been deformed or bent

in wrapping can waive the 1- 1/2 inch requirement, but the number of turns shall be maintained, and be as tight as possible.

3. Suspend bracing wires from building's structural members and metal deck as detailed on the drawings. Bracing wire anchors to the structure shall be installed in such a manner that the direction of the anchor aligns as closely as possible with the direction of the wire.
4. The slope of bracing wires shall not exceed 45 degrees from the plane of the ceiling and wires shall be taut.
5. Separate all bracing wires at least six (6) inches from all unbraced ducts, pipes, conduit, etc.
6. Size of compression struts are shown on the drawings. Attach compression struts to the main runner within 2 inches of cross runners. The compression struts shall not replace hanger wires. Compression struts shall not be installed more than 1 (horizontal) in 6 (vertical) out of plumb.

G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

H. Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall have a two (2) inch oversized ring, sleeve or adaptor through the ceiling tile to allow free movement of one (1) inch in all horizontal directions. Alternatively per ASTM E580, Section 5.2.8.5, a flexible sprinkler hose fitting that can accommodate one (1) inch of ceiling movement shall be permitted to be used in lieu of the oversized ring, sleeve, or adapter.

I. Screw attach all light fixtures and ceiling mounted air terminals, to the ceiling grid runners. Refer to details for additional requirements.

## 3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Compliance of seismic design.

B. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass inspections.

## 3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION 09 51 13**

# SECTION **09 51 23** - **ACOUSTICAL TILE CEILINGS**

## 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. Acoustical tiles for ceilings.
2. Direct attachment of tiles to substrates with adhesive.

B. Related Requirements:
1. Section 07 92 19 “Acoustical Joint Sealants for sealing joints at acoustical tile ceilings.
2. Section 09 51 13 "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. California Green Building Standards Code (GBC) Submittals:
1. Product Data: For adhesives, documentation indicating that products:
   a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2013 California Green Building Standards Code).
   b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
2. Product Data: For aerosol adhesives, and smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
   a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Exposed Moldings and Trim: Set of 6-inch- long Samples of each type and color.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

### 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. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL TILES, GENERAL

A. Source Limitations:
   1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

C. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL TILES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Fine Fissured #741 or comparable product by one of the following:
   1. CertainTeed Corp.
   2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide fire-resistance-rated tiles complying with ASTM E 1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.

2. Pattern: CE (perforated, small holes and lightly textured.)

C. Color: White.

D. LR: Not less than 0.85.

E. NRC: Not less than 0.55.

F. Edge/Joint Detail: Beveled, tongue and grooved.

G. Thickness: 1/2 inch.

H. Modular Size: 12 by 12 inches.

I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; #7841 or comparable product by one of the following:
1. CertainTeed Corp.
2. Chicago Metallic Corporation.
3. Fry Reglet Corporation.
4. Gordon, Inc.
5. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.5 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.
1. Adhesive shall have a VOC content of 50 g/L or less per GBC Table 5.504.4.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF DIRECTLY ATTACHED ACOUSTICAL TILE CEILINGS

A. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of acoustical tile adhesive and procedure recommended in writing by tile manufacturer and as follows:
   1. Prime ceiling according to CISCA's "Ceiling Systems Handbook."
   2. Remove loose dust from backs of tiles by brushing.
   3. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.

B. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

C. Arrange directionally patterned acoustical tiles as follows:
   1. Install tiles in a basket-weave pattern.

3.4 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION 09 51 23**

# SECTION **09 65 13** - **RESILIENT BASE AND 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. Resilient base.

B. Related Sections:
   1. Section 03 30 00 “Cast-in-Place Concrete” for concrete substrate and finished concrete floors.
   2. Section 09 29 00 “Gypsum Board” for wall materials to receive resilient base.
   3. Section 09 65 19 "Resilient Tile Flooring" for resilient floor tile.
   4. Section 10 11 23 “Tackable Surfaces” for wall materials to receive resilient base.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For adhesives, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicate where materials were

delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.

1. Furnish not less than 20 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## 1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## 1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg For more than 90 deg F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

# PART 2 - PRODUCTS

## 2.1 RESILIENT BASE

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      b. Endura Rubber Flooring; Division of Burke Industries, Inc.
      c. Johnsonite.
      d. Mondo Rubber International, Inc.
      e. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous) or Group II (layered).
   3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch.

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed. A mockup for a typical installation shall be done by the contractor and shall be reviewed and approved by the Architect and Owner before proceeding with either installation method.

G. Inside Corners: Job formed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      b. Johnsonite.
      c. Roppe Corporation, USA.

B. Description: Nosing for resilient floor covering, reducer strip for resilient floor covering, and transition strips.

C. Material: Rubber.

D. Profile and Dimensions: As indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

## 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products as reviewed by Architect during the submittal process.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

## 3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, in toe spaces and open ends of casework and cabinets, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned. Maintain minimum measurement of 18 inches between joints.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Scribe and fit to door frames and other interruptions.

F. Do not stretch resilient base during installation.

G. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

H. At exposed ends used preformed units.

I. Preformed Corners: Install preformed corners before installing straight pieces.

J. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Interior corners shall be mitered and tightly fitted. Use straight pieces of maximum lengths possible.

## 3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of resilient floor covering that would otherwise be exposed.

## 3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products as recommended by the Manufacturer's installation instruction until Substantial Completion.

E. END OF SECTION 09 65 13

# SECTION **09 65 19** - **RESILIENT TILE FLOORING**

## 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. Rubber floor tile.

B. Related Sections:
   1. Section 03 30 00 “Cast-in-Place Concrete” for concrete substrate.
   2. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For adhesives, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2016 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

D. Samples for Initial Selection: For each type of floor tile indicated.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

F. Installation Instructions: For each type of floor tile indicated.

G. Qualification Data: For qualified Installer.

H. Provide current subfloor preparation guidelines, as published by the Manufacturer.

I. Provide current installation guidelines, as published by the Manufacturer.

J. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicates where materials were delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.
   1. Floor Tile: Order 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 SLIP RESISTANCE

A. Flooring shall be slip resistant. Unless otherwise indicated, the static coefficient of friction (COF) shall not be less than 0.6 for level surfaces and 0.8 for ramps, per ASTM D2047 and Chapter 11B of CCR Title 24, Part 2, California Building Code as interpreted and enforced by the Division of the State Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Rubber floor tile shall be shipped from Manufacturer to Base King LLC for application of EnviroStix adhesive to back of rubber floor tile. Modified rubber floor tile shall be shipped from Base King to contractor.

B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 90 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER FLOOR TILE

A. Products: Subject to compliance with requirements, provide the following:
1. Mondo Rubber International, Inc.; Zeus.

B. Thickness: 3.5 mm.

C. Size: 100 cm x 100 cm.

D. Seaming Method: Standard.

E. Colors and Patterns: Two color pattern as shown and called for on the drawings.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by Base King LLC for applications indicated.

B. 1. Products: Schonox; Schonox SL

C. Crack and Control Joint Patching Compounds: Two-part polyurethane repair compound approved by manufacturer for applications indicated.

D. 1. Products: ARDEX Engineered Cements; ARDEX ARDIFIX

E. 2. Reinforcement: Dry Sand

F. Adhesives: VOC Free Applied Poly-Acrylic Adhesive.
1. Products: Base King LLC; EnviroStix Adhesive System:
a. Factory applied to back of tile at Base King LLC's facility in Dalton, GA.
b. C.Primer/Sealer: Base King LLC; EnviroStix Primer/Sealer

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

### 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products as reviewed by Architect during the submittal process.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity Testing: The owner shall engage an independent testing agency to perform tests recommended by adhesive manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 7 or more than 14 pH.
   4. Moisture Testing: The owner shall engage an independent testing agency to perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 18 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
   5. Adhesion Testing (Bond Test): The testing agency shall verify the adhesion compatibility test performed by the flooring subcontractor for flooring adhesives, coatings, and leveling compounds over the completed concrete substrate, as acceptable to Architect, Floor and Adhesive Manufacturer, and Owner.
   6. a.Once the subfloor preparation has been completed and is believe to be ready to receive the floor covering, the contractor shall select small areas (minimum 3 foot by 3 foot) at a rate of 1 square foot per 1000 square feet of floor area to perform the bond test.
   7. b.After a period of at least 24 hours, attempt to remove the flooring by pulling up one of the corners of the sample. If the bond is adequate, the flooring will most likely rip apart before it lets go of the substrate.
   8. c. If bond is adequate, proceed with installation of the flooring.

C. Resilient flooring shall not be installed when the relative humidity exceeds 60 percent. Contractor shall provide dehumidifiers as required to maintain 60 percent maximum relative humidity for the duration of the flooring installation.

D. Fill cracks, control joints, spalls and pop-outs in substrates with crack and control joint patching compound. Open and prepare cracks, control joints, spalls, and pop-outs as required to provide a structurally sound and clean surface for bonding. Mix with dry sand at a 1:1 ratio as recommended by the manufacturer for certain conditions that require filling and repair.

E. Fill depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

F. Do not install floor tiles until they are same temperature as space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. All surfaces must be dust free.

H. Coat substrate (roll then cross-roll) with adhesive manufacturer’s primer/sealer to ensure all surfaces are free of foreign matter. Apply second coat of primer/sealer when relative humidity of floor is 95% or greater. Failure to use the primer/sealer will void all aspects of the adhesive bond warranty.

I. Beginning of installation means acceptance of existing substrate and site conditions by the contractor, flooring installer, and the flooring and adhesive manufacturer.

## 3.3 FLOOR TILE INSTALLATION

A. Comply with adhesive manufacturer's written instructions for installing floor tile as reviewed by Architect during the submittal process.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.
   2. To insure proper placement, make layouts with paper backing on adhesive side of tile.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. 1. To ensure proper placement, make cuts with paper backing on adhesive side of tile.

F. 2. Cut pieces of tile should not be tossed onto newly installed flooring.

G. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

I. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

J. To adhere tile to substrates, remove the paper backing and stick tile to substrate. The material with exposed adhesive will stick immediately to the surface so make sure to get butt and lenth joints tighter before pressing material to floor. Keeping the tile tilted or on edge until desired placement will prevent it from sticking to soon and allow for tightest fit.

K. After tile has been installed, use a 100 lb. (or greater) roller to roll material in both horizontally and vertically to ensure a solid contact has been made with the sub-floor.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile as recommended by the Manufacturer's installation instructions until Substantial Completion.

**END OF SECTION 09 65 19**

# SECTION **09 65 19** - **RESILIENT TILE FLOORING**

## 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. Rubber floor tile.

B. Related Sections:
   1. Section 03 30 00 “Cast-in-Place Concrete” for concrete substrate.
   2. Section 07 26 50 “Vapor Emission Control System” for testing and vapor control.
   3. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For adhesives, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2013 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

E. Installation Instructions: For each type of floor tile indicated.

F. Qualification Data: For qualified Installer.

G. Provide current subfloor preparation guidelines, as published by the Manufacturer.

H. Provide current installation guidelines, as published by the Manufacturer.

I. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicates where materials were delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.
   1. Floor Tile: Order 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 SLIP RESISTANCE

A. Flooring shall be slip resistant. Unless otherwise indicated, the static coefficient of friction (COF) shall not be less than 0.6 for level surfaces and 0.8 for ramps, per ASTM D2047 and Chapter 11B of CCR Title 24, Part 2, California Building Code as interpreted and enforced by the Division of the State Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. The school district will be purchasing the flooring and adhesive directly from the manufacturer based upon quantities identified by the contractor. The contractor will coordinate with the Facilities Planning Department to order the flooring and adhesive. The contractor will accept delivery of the flooring and adhesive from the manufacturer. The contractor is responsible for offloading the flooring and adhesive.

B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 90 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 RUBBER FLOOR TILE

A. Products: The school district will purchase the flooring directly from the manufacturer:
   1. Mondo Rubber International, Inc.; Zeus.

B. Thickness: 3.5 mm.

C. Size: 100 cm x 100 cm.

D. Seaming Method: Standard.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

F. Quantities: Identify required quantities of floor tile needed for installation and submit to owner through Architect.

### 2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Refer to Section 07 26 50 “Vapor Emission Control System.”

B. Adhesives: Water-resistant type.
   1. Products: The school district will purchase the adhesive directly from the manufacturer:
      a. Mondo Rubber International, Inc.; PU-105 (Polyurethane).
      b. Quantities: Identify required quantities of adhesives needed for installation of the floor tile and submit to owner through Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

## 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products as reviewed by Architect during the submittal process.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Contractor shall be responsible for scheduling the tests and performing the necessary remediation work specified in Section 07 26 50 “Vapor Emission Control System” to allow for the installation of the resilient flooring.
   4. Proceed with installation only after substrates pass testing in Section 07 26 50 “Vapor Emission Control System” and are acceptable to the Flooring and Adhesive Manufacturer.

C. Resilient flooring shall not be installed when the relative humidity exceeds 60 percent. Contractor shall provide dehumidifiers as required to maintain 60 percent maximum relative humidity for the duration of the flooring installation.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until they are same temperature as space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

G. Beginning of installation means acceptance of existing substrate and site conditions by the contractor, flooring installer, and the flooring and adhesive manufacturer.

## 3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile as reviewed by Architect during the submittal process.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Rubber Floor Tile Installation: When epoxy and polyurethane adhesives are used, grey concrete utility bricks (2”x4”x8”) or oblong sandbags shall be used to cover every seam in order to maintain contact between the material and the adhesive until it has fully set. Refer to the manufacturer’s written installation instructions for the quantity of bricks/sandbags to be used for a particular flooring system.

## 3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile as recommended by the Manufacturer's installation instructions until Substantial Completion.

**END OF SECTION 09 65 19**

# SECTION **09 72 00** - **FIBERGLASS REINFORCED PANELS**

## 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 glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

### 1.3 SUBMITTALS

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

B. California Green Building Standards Code (GBC) Submittals:
   1. Product Data: For adhesives, documentation indicating that products:
      a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2016 California Green Building Standards Code).
      b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.
   2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):
      a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.
   3. Testing Agency: UL.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Do not deliver to the job site until suitable storage space is available.

B. Storage, Handling and Protection: Provide all work or materials necessary to store, cover and protect materials specified and installed under this Section. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Prevent marring of finished surfaces and keep materials clean during handling and installation operations. Protect exposed finish work and materials from damage after installation. Replace damaged items at no cost to Owner.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide **Marlite, Inc.; Marlite FRP Class A** or comparable product by one of the following:
      a. Kemlite Company Inc.
      b. Glasteel, a division of Stabilt America, Inc.
      c. Nudo Products, Inc.
      d. Panolam Industries International, Inc.
   2. Nominal Thickness: Not less than 0.09 inch.
   3. Surface Finish: Molded pebble texture.
   4. Color: P-100 “White”.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: Match panels.

B. Adhesive: Water resistant and non-flammable adhesive, recommended by plastic paneling manufacturer and complying with ASTM C557.

C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

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

### 3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations, but not less than 24 hours before application.

E. Other trade work that penetrates the substrate shall be completed before beginning FRP panel application.

F. Remove switchplates, wall plates, and surface mounted fixtures in areas where wall covering is to be applied.

G. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
   1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
   2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

### 3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive. Do not fasten through panels. All trim accessories must provide for a minimum 1/8 inch of panel expansion at joints and edges, for proper installation.

D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Replace removed plates and fixtures; verify cut edges of panels area completely concealed.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

**END OF SECTION 09 72 00**

# SECTION 09 91 00 – PAINTING AND FINISHING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Surface preparation.

B. Painting schedules, including painting of exposed surfaces, interior and exterior, except as otherwise specified or indicated.

### 1.2 RELATED SECTIONS

A. Section 05 50 00 – Metal Fabrications: Shop Primed Surfaces.

B. Section 06 20 13 – Exterior Finish Carpentry.

C. Section 06 20 23 – Interior Finish Carpentry.

D. Section 07 62 00 – Sheet Metal Flashing and Trim.

E. Section 08 11 13 – Hollow Metal Doors and Frames.

F. Section 08 31 13 – Access Doors and Frames.

G. Section 09 24 00 – Portland Cement Plastering.

H. Section 09 29 00 – Gypsum Board.

I. Divisions 21 – 23 – Mechanical Sections as applicable to the Project.

J. Divisions 25 – 28 – Electrical Sections as applicable to the Project.

### 1.3 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Section 01 42 00 for definitions, acronyms, and abbreviations.

B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual

C. Referenced Standards:

1. ASTM D523 – Standard Test Method for Specular Gloss.
2. The Master Painters Institute, MPI Gloss and Sheen Levels.

### 1.4 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with sufficient documented experience.

B. Applicator: Company specializing in commercial painting and finishing with sufficient documented experience.

C. Gloss Levels: Per Master Painters Institute (MPI) gloss standards “MPI Gloss and Sheen Levels,” measured in accordance with ASTM D523.

| GLOSS LEVEL | DESCRIPTION | GLOSS AT 60 DEGREES ASTM D523 | SHEEN AT 85 DEGREES ASTM D523 |
|---|---|---|---|
| G1 | A traditional matte finish – flat. | 5 units, maximum | and 10 units, maximum |
| G2 | A high side sheen flat - "a velvet-like" finish. | 10 units, maximum | and 10 - 35 units |
| G5 | A traditional semi-gloss. | 35 - 70 units | - |
| G6 | A traditional gloss. | 70 - 85 units | - |
| G7 | A high gloss. | More than 85 units | - |
| | | | |

1.5 REGULATORY REQUIREMENTS

A. Conform to California Building Code for flame spread and smoke density requirements for finishes.

B. Furnish certification that all paint coatings furnished for the location of the project comply with the EPA clean air act for permissible levels of volatile organic content for architectural coatings applied in California as designated by California Air Resources Board (CARB), 2016 California Green Building Standards Code, and the San Joaquin Valley Air Pollution Control District (SJVAPCD).

1.6 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Provide product data on all finishing products.

C. Submit four brush-out samples 8 inches by 10 inches in size illustrating color and gloss level selected for each surface finishing product scheduled.

D. Field Sample: Furnish sample of actual paint colors selected on portion of building item to receive paint as directed by Architect, prior to beginning interior and exterior painting.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in manufacturer's original unopened, labeled containers; inspect to verify acceptance.

B. Store and protect products from abuse and contamination.

C. Container labeling is to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 50 degrees F and a maximum of 90 degrees F, in well-ventilated area, unless required otherwise by manufacturer's instructions.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior work and interior work, unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.9 EXTRA STOCK

A. Provide a new and unopened five-gallon container of each type, color and sheen to Owner.

B. Label each container with color, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 PAINT SYSTEMS, 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.

2.2 SUSTAINABLE DESIGN REQUIREMENTS

A. VOC Content: Provide materials that comply with VOC limits set by Rule 4601 of the San Joaquin Valley Air Pollution Control District and 2013 California Green Building Standards Code Table 5.504.4.3; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints and Coatings: VOC content not more than 50 g/L.
2. Primers, Sealers, and Undercoaters: VOC content not more than 100 g/L.
3. Nonflat Paints and Coatings: VOC content not more than 100 g/L.
4. Anti-Corrosive and Anti-Rust Paints and Primers applied directly to Ferrous Metals: VOC content not more than 250 g/L.
5. Zinc-Rich Primer applied to Galvanized and Ferrous Metals: VOC content not more than 340 g/L.

B. Chemical Components of **Field-Applied Interior Paints and Coatings**: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.
b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1, 2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

2.3 ACCEPTABLE MANUFACTURERS – PAINT

A. Refer to Table at the end of this Section.

B. Substitutions: Under provisions of Section 01 25 13.

2.4 ACCEPTABLE MANUFACTURERS – PRIMER SEALERS

A. Refer to Table at the end of this Section.

B. Substitutions: Under provisions of Section 01 25 13.

2.5 ACCEPTABLE MANUFACTURERS – STAIN AND CLEAR FINISHES

A. Refer to Table at the end of this Section.

B. Substitutions: Under provisions of Section 01 25 13.

2.6 MATERIALS

A. All paint materials shall be provided from a single manufacturer unless noted otherwise in this Section.

B. Coatings: Ready mixed. Process pigments to a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating.

C. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

D. Accessory Materials: All other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

E. All Materials specified by brand name or manufacturer shall be delivered unopened at the job in their original containers.

2.7 FINISHES

A. Refer to schedule at end of Section for surface finish schedule.

PART 3 EXECUTION

3.1 GENERAL

A. Storage: All materials used by the painting contractor shall be stored and mixed in a place designated by the Owner or the Architect. The storage place must be kept neat and clean at all times. All cloths, waste or other material that might constitute a fire hazard shall be placed in a suitable metal container or shall be removed from the site or destroyed at the end of each day's work.

3.2 INSPECTION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application to the Architect, Architect's representative or inspector in writing. The Architect will cause such defect to be remedied.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster; Gypsum Wallboard: 12 percent.
2. Concrete Masonry Units: 10 percent.
3. Interior Located Wood: 15 percent.
4. Exterior Located Wood: 7 percent.

D. Beginning of application constitutes acceptance of the surfaces.

3.3 PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or painting.

B. Correct minor defects and clean surfaces that affect work of this Section.

C. Seal marks that may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Gypsum Board Surfaces: Latex fill minor defects. Spot-prime defects after repair.

F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer, unless otherwise recommended by finish coating system manufacturer.

G. Shop-Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces as recommended by primer manufacturer. Prime shop-primed steel items with steel primers specified in this Section.

H. Concrete, Stucco and Masonry: All dust and loose mortar shall be removed by sweeping or by brushing with a stiff fiber or wire brush.

1. Concrete and masonry surfaces that show signs of efflorescent shall be treated with a zinc sulfate wash (3lbs. per gallon of water), or by scrubbing affected areas with a solution of muriatic acid. Remove loose crystals and rinse with clear water. Allow to dry thoroughly before painting.

a. All surfaces defects and all cracks more than 1/16 inch wide shall be filled with patching plaster or spackle according to package directions and textured to match adjacent areas.
b. Form oils or separating agents that might impair the adhesion or the appearance of the specified finish shall be removed before any materials are applied.

2. Plaster work that has cured for less than two months and all other plaster areas that show the presence of excessive amounts of free alkali when tested with phenolphthalein or some other suitable means shall be treated with a zinc sulfate wash (3 lbs. per gallon of water) to neutralize the alkali and obtain the optimum of surface carbonation.

a. All surface Cracks greater than 1/32 inch wide, holes and other surface defects shall be repaired as recommended by the finish paint manufacturer's written instructions.

I. Interior Wood Items Scheduled to Receive Finish: Hand sandpaper and wipe off dust and grit prior to priming. Seal knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

1. At woodwork with transparent finish, nail holes, cracks or defects shall be filled with wood filler tinted to match color of stain.

3.4 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.5 WORKMANSHIP

A. All work shall be performed by experienced mechanics in a skillful manner. All materials shall be evenly applied so as to be free from sags, crawls or other defects. Coats shall be of the proper consistency and well brushed out as to show the minimum brush marks, except varnish and enamel which shall be uniformly applied. Brushes shall be clean and in good condition. All areas with a transparent coat will be repainted at contractor's expense.

B. All painting shall be by brush, except plaster and gypsum board which shall be by brush and roller. Underside of soffits, covered walks, acoustical panels and screens may be completed by spraying.

C. No work shall be completed under conditions that are unsuitable for the production of good results. No painting shall be completed while plaster is curing, or while wood sawing, sanding or cleaning is in process. Coats shall be thoroughly dry before the succeeding coat is applied. Finishes shall be uniform as to sheen, shine, color and texture, except when glazing is required.

D. No exterior painting shall be done in rainy, damp, or frosty weather. No Interior painting or finishing shall be permitted until the building has been thoroughly dried out by artificial heat. A minimum temperature of 50 degrees Fahrenheit shall be maintained in areas where the application or drying of paint is occurring.

E. This contractor shall take into account that not less than the following percentages of total surfaces shall be painted in deep (dark) tones of color selected: (This includes colors requiring ultra-deep bases)

| | | |
|---|---|---|
| 1. | Walls: | 25% |
| 2. | Ceilings: | 25% |
| 3. | Doors and Door Frames: | 100% |
| 4. | Sheet Metal: | 50% |
| 5. | Exposed Steel: | 100% |

3.6 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

1. Paint mil thicknesses shall not be less than the minimums recommended by the paint manufacturers.
2. No Paint, varnish or stain shall be reduced or applied in any way except as herein specifically called for, or recommended by the manufacturer.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Prime back surfaces of interior and exterior woodwork with primer paint, type as recommended by manufacturer.

I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.7 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. See Divisions 21 – 23 and 25 – 28 for other items requiring painting.

B. Paint interior surfaces of air ducts and convector heating cabinets that are visible through grilles and louvers with one) coat of flat black paint, to limit of sight line. Paint dampers exposed behind grilles to match face panels. Paint all new interior and exterior exposed ductwork and ductwork supports. Paint all new conduit, pipes and conduit/pipe supports in exposed interior and exterior locations.

C. Reinstall electrical plates, hardware, light fixture trim, and fittings removed for surface preparation or painting.

D. Do not paint factory-finished mechanical and electrical equipment.

3.8 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed or spattered.

B. During progress of Work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove from site daily.

3.9 PAINTING SCHEDULE – EXTERIOR SURFACES:

A. Ferrous Metal – **3EN Finish**
1st coat – Alkyd Flat Primer
2nd and 3rd coats – 100 percent Acrylic Semi Gloss

B. Ferrous Metal (Industrial) – **3IND Finish**
1st coat – Epoxy Flat Primer
2nd and 3rd coats – Aliphatic Urethane Gloss Enamel
For use at exterior metal architectural features/exposed structure

C. Galvanized Metal (Handrail and Guardrail Assemblies only) – **3EN Finish**
1st coat – Etch Prep
2nd coat – Epoxy Satin Primer
3rd and 4th coats – High Dispersion Pure Acrylic Polymer

D. Galvanized Metal and Aluminum (Except Handrail and Guardrail Assemblies) – **3EN Finish**
1st coat – Etch Prep
2nd coat – Acrylic Flat Primer
3rd and 4th coats – 100 percent Acrylic Semi-Gloss

E. Exposed Concrete and Cement Plaster System with Cementitious Finish Coat – **3EX Finish**
1st coat – Acrylic Flat Primer
2nd and 3rd coats – Elastomeric Flat

F. Cement Plaster System with Acrylic Finish Coat – **3EX Finish**
1st coat – Acrylic Flat Primer
2nd and 3rd coats – Elastomeric Flat

G. Wood – **3EX Finish**
1st coat – Alkyd Flat Primer
2nd and 3rd coats – 100 percent Acrylic Flat

H. Wood – **3EN Finish**
1st coat – Alkyd Flat Primer
2nd and 3rd coats – 100 percent Acrylic Semi-Gloss

I. Pressure Treated Wood – **3EN Finish**
1st coat – Alkyd Flat Primer
2nd and 3rd coats – 100 percent Acrylic Satin

J. Masonry (CMU) – **3EX Finish**
1st coat – Acrylic Block Filler Primer
2nd and 3rd coats – Elastomeric Flat

3.10 PAINTING SCHEDULE – INTERIOR SURFACES:

A. Gypsum Board – **3WW Finish**
1st coat – PVA Primer Sealer
Texture by Section 09 29 00 Contractor
2nd coat – PVA Primer Sealer – Tint towards final color.
3rd and 4th coats – Latex Semi-Gloss Enamel
Typical paint system at toilet rooms, storage rooms, corridors.

B. Gypsum Board – **3EN Finish**
1st coat – PVA Primer Sealer
Texture by Section 09 29 00 Contractor
2nd coat – PVA Primer Sealer – Tint towards final color.
3rd and 4th coats – Latex Semi-Gloss Enamel

C. Interior Cement Plaster – **3WW Finish**
1st coat – PVA Primer Sealer
2nd coat and 3rd coats – Latex Semi-Gloss Enamel

D. Wood (Opaque Finish) – **3EN Finish**
1st coat – Alkyd Flat Primer – Tint towards final color.
2nd and 3rd coats – Latex Semi-Gloss Enamel

E. Ferrous Metal – **3EN Finish**
1st coat – 100% Acrylic Metal Primer
2nd and 3rd coats – Latex Semi-Gloss Enamel
Typical paint system at all hollow metal doors, pressed metal frames, and exposed steel structure.

F. Concrete – **3WW Finish**
1st coat – Acrylic Flat Primer – Tint towards final color
2nd and 3rd coats – Latex Semi-Gloss Enamel

G. Masonry (CMU) – **3WW Finish**
1st coat – Acrylic Block Filler Primer
2nd and 3rd coats – Latex Semi-Gloss Enamel

H. Existing Interior Cement Plaster – **3WW Finish**
1st and 2nd coats – Latex Semi-Gloss Enamel

I. Galvanized Metal, Zinc Alloy Metal and Aluminum – **3EN Finish**
1st coat – Etch Prep
2nd coat – Acrylic Flat Primer – Tint towards final color.
3rd and 4th coats – Latex Semi-Gloss Enamel

PAINTING SCHEDULE

| APPLICATION | TYPE | MPI Gloss Level | MANUFACTURERS | | | | |
|---|---|---|---|---|---|---|---|
| | | | PPG Glidden | Sherwin Williams | Kelly Moore | MDC | Tnemec |
| **PRIMERS** | | | | | | | |
| Exterior Ferrous Metal | Alkyd | G1 | 90-712 | B50WZ | 1710 | - | - |
| Exterior Ferrous Metal (Industrial) | Epoxy | G1 | Amerlock 2 VOC | B58 Series 646 | 7125 | - | - |
| Exterior Galvanized Metal and Aluminum (Except Handrail and Guardrail Assemblies) | Acrylic | G1 | 90-712 | B66W1 | 1722 | - | - |
| Exterior Galvanized Metal (Handrail and Guardrail Assemblies Only) | Epoxy | G1 | Amerlock 2 VOC | - | - | - | V69 |
| Exterior Wood and Pressure Treated Wood | Alkyd | G1 | GP3210 | B42W41 | 220 | - | - |
| Exterior Cement Plaster and Concrete; and Interior Concrete | Acrylic | G1 | GP3210 | A24W300 | 247 | - | - |
| Exterior Cement Plaster System with Acrylic Finish Coat | Acrylic | G1 | GP3210 | A100 | 250 | - | - |
| Exterior and Interior Masonry (Block Filler) | Acrylic | G1 | 6-7 | B25W25 | 521 | - | - |
| Interior Gypsum Board& Cement Plaster | PVA | G1 | 6-2 | B28W400 | 971 | - | - |
| Interior Wood | Alkyd | G1 | 17-951 | B49WZ2 | 975 | - | - |
| Interior Ferrous Metal | Alkyd | G1 | 90-712 | B66-310 | 1710 | - | - |
| Interior Aluminum, Ferrous & Galvanized Metal | Acrylic | G1 | 90-712 | B66W1 | 1725 | - | - |
| | | | | | | | |
| | | | | | | | |
| **FINISHES** | | | | | | | |
| Exterior Ferrous & Galvanized Metal, Aluminum, Wood and Pressure Treated Wood (Except Handrail and Guardrail Assemblies) | 100 percent Acrylic | G5 | 6-900XI | A8 | 1250 | - | - |
| Exterior Ferrous Metal (Industrial) | Aliphatic Urethane Enamel | G6 | 95-812 Series | B65 Series | - | - | - |
| Exterior Galvanized Metal (Handrail and Guardrail Assemblies Only) | High Dispersion Pure Acrylic | G5 | 90-474 | - | - | - | 1029 |
| Exterior Cement Plaster, Concrete, and CMU | Elastomeric | G1 | 2221 | A5-400 Series | 1128 | - | - |
| Exterior Wood and Masonry | 100 percent Acrylic | G1 | 6-610XI | A6 | 1240 | - | - |
| Exterior Pressure Treated Wood | 100 percent Acrylic | G4 | 6-2045XI | A82 | 1245 | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Interior Gypsum Board, Wood, Masonry (CMU) and Concrete, Wood, Ferrous Metal, and Galvanized Metal | Latex Enamel | G5 | 6-500 | B31W251 | 1520 | - | - |
| Interior Gypsum Board | Latex Enamel | G5 | 6-500 | B30W251 | 1520 | - | - |
| Interior Ferrous & Galvanized Metal and Aluminum | Latex Enamel100 percent Acrylic | G5 | 82-500 | B30W200- | 1685 | - | - |
| Interior Plaster (existing and new) | Latex Enamel | G5 | 6-500 | B30W251 | 1520 | - | - |
| **MISCELLANEOUS** | | | | | | | |
| Exterior Heavy Duty Cleaner | Water-Based | N/A | 88 | | Jasco Prep & Prime | | - |
| Exterior & Interior Galvanized Metal Etch Prep. | N/A | N/A | Dissco Eco-Prime 100 or Jasco Prep & Prime | | | | |
| | | | | | | | |

**END OF SECTION**

## LOW MAINTENANCE TREE LIST for STOCKTON UNIFIED SCHOOL DISTRICT

**Small Trees – under 30 feet high**
These trees are suitable for use in small tree wells or planters (3ft. X 3ft. or 4ft. X 4ft.), in narrow (2 to 3 feet wide) park strips (area between curb and sidewalk), or underneath power lines.

Japanese Maple (*Acer palmatum*) D, C, use standard green or red leaf varieties
Norway Maple (*Acer platanoides "Columnare" or 'Crimson King'*) D, C
Crape Myrtle (*Largerstroemia hybrids, 'Biloxi'-pale pink, 'Muskogee'-lavender, 'Natchez'-white, 'Tonto'-red, 'Tuscarora'-pinkish-red, 'Tuskegee'-deep pink*) D, DR, F, C
Southern Magnolia (*Magnolia grandiflora 'Little Gem' or 'St Mary'*) E, F
African Sumac (*Rhus lancea*) E, DR
Xylosma (*Xylosma Congestum*) E, DR, train as single trunk

**Medium Trees – 30 feet to 60 feet high**
These trees are suitable for most average sized or large front yards, in larger park strips (5 feet or more wide), or in parks and greenbelts.

Autumn Blaze Maple (*Acer x freemanii 'Autumn Blaze'*) D, C
Red Maple (*Acer rubrum 'Red Sunset' or 'October Glory'*) D, C
Eastern Redbud (*Cercis canadensis*) D, DR, F, C
Arizona Cypress (*Cupressus arizonica*) E, DR
Ginkgo (*Ginkgo biloba 'Fairmont' or 'Autumn Gold'*) D, C, PF
Chinese Pistacia (*Pistacia chinensis 'Keith Davey'*) D, DR, C, PF, male variety-no seed pods
Yarwood Sycamore (*Platanus acerifolia 'Yarwood'*) D, DR
Fern Pine (*Podocarpus gracilior*) E, PF
Coast Live Oak (*Quercus agrifolia*) E, N, DR
Scarlet Oak (*Quercus coccinea*) D, C
Sawleaf Zelkova (*Zelkova serrata 'Village Green' or 'Green Vase'*) D, DR, C

**Large Trees – over 60 feet high**
These trees are most suitable for larger areas such as parks, greenbelts, or large front yards with no overhead obstructions.

Big Leaf Maple (*Acer macrophyllum*) D, N, C
Incense Cedar (*Calocedrus decurrens*) E, N, DR
Canary Island Pine (*Pinus canariensis*) E, DR
Ponderosa Pine (*Pinus ponderosa*) E, N, DR
California Sycamore (*Platanus racemosa*) D, N, DR
Valley Oak (*Quercus lobata*) D, N, DR

**Descriptive Key:**

| | | |
|---|---|---|
| E = evergreen | D = deciduous | |
| N = California native | DR = drought tolerant | |
| F = flowering | C = fall color, deciduous | PF = relatively pest free |

**TREES TO AVOID PLANTING**

## LOW MAINTENANCE TREE LIST for STOCKTON UNIFIED SCHOOL DISTRICT

Avoid planting any tree with: fruit, or undesirable seeds, cones or nuts (trip hazards), with a voracious, shallow root system that is known to cause sidewalk or driveway damage, or any tree with an uncontrollable pest (disease, insect or invertebrate) problem.

**Examples:**

Coast Redwood (*Sequoia sempervirens*) and Deodar Cedar (*Cedrus deodara*)
Fungus disease Botryosphaeria Canker – usually fatal in most case, extensive in San Joaquin County

Liquidamber (*Liquidamber species*) - extensive, destructive, and shallow root system, excessive litter, especially seeds

Ash (*Fraxinus species*) - extensive, destructive, and shallow root system, insects

Mosesto Ash (*Fraxinus velutina 'Modesto'*) - poor structure and broken branches, diseases

Locust (*Gleditsia and Robinia species*) - extensive, destructive, and shallow root system, excessive litter, diseases, and insects

Privet (*Ligustrum species*) – excessive litter and berries

Goldenrain Tree (Koelreuteria paniculata) – excessive litter and seeds

Chinese Evergreen Elm (*Ulmus parvifolia*) – excessive litter and pruning requirements

Elms (*Ulmus species*) – not drought tolerant, insects, disease

Pears (*Pyrus species*) – excessive litter, poor structure and broken branches, diseases

Tulip Tree (*Liriodendron tulipifera*) – not drought tolerant, insects

Hackberry (*Celtis species*) – insects and disease

Flowering Plums (*Prunus species*) and Flowering Apples (*Malus species*) – excessive litter, fruit and flowers

Strawberry Tree (Arbutus species) – litter and excessive fruit drop

## LOW MAINTENANCE TREE LIST for STOCKTON UNIFIED SCHOOL DISTRICT

# SECTION 10 10 00 – MISCELLANEOUS SPECIALTIES

1. GENERAL:

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK: (provide and install complete)

A. Section Includes:

1. Extreme Short Throw Digital Projector
2. LCD Projector Mount and Accessories (Wall Mount)
3. Battery Operated Radio Control Clock
4. Portable Assistive Listening System

B. Related Sections:

1. Section 10 14 00 “Signage and Graphics” for Assistive Listening System Sign.

1.3 QUALITY ASSURANCE:

A. Manufacturer’s Data: Provide complete manufacturer’s data, including installation instructions and details to contractor’s job Superintendent, to facilitate coordination of work.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer’s technical data and installation instructions for each material and component part, including data substantiating that materials comply with requirements.

B. Shop Drawings: Submit for each type of product. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, and accessories, and installation details.

C. Certification: Submit manufacturer’s certification that all materials furnished for project comply with requirements specified herein.

2. PRODUCTS:

2.1 EXTREME SHORT THROW DIGITAL PROJECTOR:

A. Basis-of-Design Product: Subject to compliance with requirements, provide Vivitek; D755WT or comparable product by one of the following:

1. Architect and District approved equal.

2.2 LCD PROJECTOR MOUNT AND ACCESSORIES (WALL MOUNT):

A. Basis-of-Design Product: Subject to compliance with requirements, provide Vivitek; WM-3 Wall-Mount Bracket or comparable product by one of the following:

1. Architect and District approved equal.

2.3 BATTERY OPERATED RADIO CONTROLLED CLOCKS:

A. Basis-of-Design Product: Subject to compliance with requirements, provide American Time; Part #E56BAND301BP, Radio Controlled Clocks – 12 inch Round Surface, Full Numbered Dial, Black Case, and an on-board radio receiver to receive time signal transmitted by the National Institute of Standards and Technology (NIST) from Fort Collins, Colorado or comparable product by one of the following:

1. Atomic Time
2. Howard Miller

2.4 PORTABLE ASSISTIVE LISTENING SYSTEM:

A. Furnish a portable RF (radio frequency) wireless assistive listening system for use by the hearing-impaired. The assistive listening system (ALS) shall be capable of transmitting up to six (6) channels of audio simultaneously on the 72 MHz band. The ALS system shall offer a choice between 57 channels for flexibility and ease of setup. The ALS system shall have 80dB SNR or greater, end-to-end. Receivers shall be frequency agile and frequency set with a "seek" button. The receiver will incorporate a stereo headset jack that allows the user to plug in either a mono or stereo headset and listen to audio normally. The portable receivers and transmitters shall incorporate automatic battery charging circuitry for recharging of Ni-MH batteries.

B. Basis of Design Manufacturer: Subject to compliance with requirements, provide portable assistive listening system packages manufactured by Listen Technologies Corporations or comparable products by one of the following

1. Williams Sound
2. Architect and District Approved Equal.

C. Portable Assistive Listening System (Classroom Building L – Small Conference Room):

1. Listen Technologies Corporation: ListenPortable 72MHz RF System with the following options and accessories:

a. LT-700-072 Portable RF Display Transmitter (Qty: 1 ea.)

b. LA-277 Conference Microphone (Qty: 1 ea.)

c. LR-400-072 Portable Display RF Receiver (Qty: 2 ea.)

d. LA-164 Ear Speaker (Qty: 2 ea.)

e. LA-166 T-coil Neckloop (for hearing aid compatibility) (Qty: 2 ea.)

f. LA-362 NiMH rechargeable batteries (pkg. of 2) (Qty: 3 ea.)

g. LA-323 4-unit Portable RF Products Charging/Carrying Case w/ Removable Lid (Qty: 1 ea.)

3. EXECUTION

3.1 GENERAL

A. Field Conditions: Inspect field condition for suitability of proper installation. Inform contractor of conditions requiring attention. Make field measurements as required.

3.2 INSTALLATION

A. Follow manufacturer's printed installation instructions and as shown on plans.

B. Provide battery operated, radio controlled clocks at each space designated on the Electrical Drawings.

3.3 DEMONSTRATION AND TRAINING

A. Before the date of beneficial occupancy/substantial completion, demonstrate and provide training to SUSD personnel and staff per Section 01 79 00 "Demonstration and Training."

## END OF SECTION 10 10 00

# SECTION **10 11 00** - **VISUAL DISPLAY SURFACES**

## 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. Markerboards.
   2. Visual display rails.
   3. Sliding visual display units.

B. Related Sections:
   1. Section 10 11 23 "Tackable Surfaces" for tackable, fabric-covered wall surfaces.

### 1.3 DEFINITIONS

A. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

B. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of markerboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

### 1.4 SUBMITTALS

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

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of panel joints.
   2. Show locations of special-purpose graphics for visual display surfaces.
   3. Include sections of typical trim members.

C. Samples for Verification: For each type of visual display surface indicated.
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch- long sections of each trim profile.
   3. Display Rail: 6-inch- long sections.
   4. Accessories: Full-size Sample of each type of accessory.

D. Product Schedule: For visual display surfaces. Use same designations indicated on Drawings.

E. Qualification Data: For qualified Installer.

F. Warranties: Sample of special warranties.

G. Operation and Maintenance Data: For visual display surfaces to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
   1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

## 1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
   1. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.

B. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish.

C. Extruded Aluminum: ASTM B 221, Alloy 6063.

### 2.2 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch-thick, porcelain-enamel face sheet with matte finish for use with a wall mounted digital projector.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Claridge Products and Equipment, Inc.
      b. AARCO Products, Inc.
      c. ADP Lemco, Inc.
      d. Aywon.
      e. Bangor Cork Company, Inc.
      f. Best-Rite Manufacturing.
      g. Egan Visual Inc.
      h. Ghent Manufacturing, Inc.
      i. Marsh Industries, Inc.; Visual Products Group.
      j. Platinum Visual Systems; a division of ABC School Equipment, Inc.
      k. PolyVision Corporation; a Steelcase company.
      l. Tri-Best Visual Display Products.
   2. Manufacturer's Standard Core: Minimum 3/8 inch thick, with manufacturer's standard moisture-barrier backing.
   3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

### 2.3 VISUAL DISPLAY RAILS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Claridge Products and Equipment, Inc.
   2. A-1 Visual Systems
   3. AARCO Products, Inc.
   4. Marsh Industries, Inc.; Visual Products Group.
   5. Platinum Visual Systems; a division of ABC School Equipment, Inc.

B. General: Manufacturer's standard, aluminum-framed, tackable cork visual display surface fabricated into narrow rail shape and designed for displaying material.

## 2.4 SLIDING VISUAL DISPLAY UNITS

A. Horizontal-Sliding Visual Display Units: Factory-fabricated units consisting of extruded-aluminum tubular frame, fixed-rear visual display panel, aluminum-framed horizontal-sliding panels, and extruded-aluminum fascia that conceals overhead sliding track; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Claridge Products and Equipment, Inc.
      b. A-1 Visual Systems.
      c. AARCO Products, Inc.
      d. Platinum Visual Systems; a division of ABC School Equipment, Inc.
   2. Two-Track Units: Fabricate unit without fixed rear panel. Provide two sliding panels, each equal to not less than one-half of overall length of unit.
   3. Three-Track Units: Fabricate unit without fixed rear panel. Provide three sliding panels, each equal to not less than one-third of overall length of unit.
   4. Sliding Panels: Fabricated from not less than 1/2 inch- thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.
      a. Fabricate sliding panels with 0.021-inch uncoated thickness, porcelain-enamel face sheets.
   5. Hardware: Manufacturer's standard, extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.

## 2.5 ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated on Drawings.
   1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous.
   1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Flag Holder: One for each room.

D. Paper Holder (Length of Markerboards): Extruded aluminum; designed to hold paper by clamping action.

E. Special-Purpose Graphics (Where indicated): Fuse or paint the following graphics into surface of porcelain-enamel visual display unit:
   1. Music staff lines.
   2. Grid, 1 inch square.
   3. Graph coordinates, rectangular.
   4. Polar coordinates.

## 2.6 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Provide manufacturer's standard vertical-joint H-trim system between abutting sections markerboards.
   2. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

## 2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

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

## 2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## 2.9 VISUAL DISPLAY SURFACE SCHEDULE

A. Visual Display Board (Factory assembled):
   1. Markerboard: Porcelain-enamel markerboard assembly.
      a. Color: White.
   2. Corners: Square.
   3. Width: As indicated on Drawings.
   4. Height: As indicated on Drawings.
   5. Mounting: Wall.
   6. Mounting Height: As indicated on Drawings.
   7. Factory -Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
   8. Accessories:
      a. Chalktray: Solid type.
      b. Paper Holder and flag holder

B. Sliding Visual Display Unit:
   1. Horizontal-Sliding Type: Two-track unit or Three-track unit.
      a. Sliding Panels: Porcelain-enamel markerboard assembly.
         1) Color: White.

2. Overall Width: As indicated on Drawings.
3. Overall Height: As indicated on Drawings.
4. Mounting Height: As indicated on Drawings.
5. Factory-Applied Aluminum Trim: Manufacturer's standard.
   a. Finish: Clear anodic.
6. Accessories:
   a. Chalktray.
   b. Map rail with display rail, end stops, map hooks and clips, and flag holder.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine walls and partitions for proper preparation and backing for visual display surfaces.

C. Examine millwork for proper preparation where sliding visual display units will be installed.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare millwork for sliding visual display units as required by type and size of unit.

D.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards: Attach visual display board to wall as indicated on drawings.

B. Sliding Visual Display Units: Install units in recessed locations and at mounting heights indicated. Attach to architectural millwork as indicated with fasteners at not more than 16 inches o.c.
   1. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

**END OF SECTION 10 11 00**

# SECTION 10 11 23 – TACKABLE SURFACES

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –1 Specifications sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of wall coverings required is indicted on drawing and in schedules.

B. Types of wall covering required include the following:

1. Vinyl-coated fabric tackable wall panels (VFTW).

a. Vinyl-covered trim for VFTW.

1.3 QUALITY ASSURANCE:

A. Manufacturer: Provide each type of wall covering as produced by a single manufacturer, including recommended primers, adhesives sealants, and trim.

B. Installers: A firm specializing in wall covering work with not less than three years of experience in installing wall coverings similar to those required for this project.

C. Fire Hazard Classification for Vinyl Wall Covering per CBC 803.1.4: Provide materials bearing UL label and marking, indicting fire hazard classification of wall covering, as determined by ASTM E 84.

1. Flame spread not more than 25.
2. Fuel contributed not more than 15.
3. Smoke developed not more than 25.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data and installation instructions for VFTW, trim, and installation materials.

B. California Green Building Standards Code (GBC) Submittals:

1. Product Data: For adhesives, documentation indicating that products:

a. Comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 (2016 California Green Building Standards Code).

b. Comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene) except for aerosol products as specified in GBC 5.504.4.1.2.

2. Product Data: For smaller unit sizes of adhesives (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces):

a. Comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

C. Samples: Submit full width samples (12" x 12" minimum) of VFTW, illustrating range of color and pattern variation; submit sets of sample moldings.

D. Certification: Submit manufacturer's certification that materials furnished comply with requirements specified.

E. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including precautions for use of cleaning materials which could damage wall coverings.

F. Replacement Materials: After completion of work, deliver to project site not less than 6 linear yards of each type, color, and pattern of wall covering installed. Furnish replacement materials from same production run as materials installed.

1.5 DELIVERY AND STORAGE:

A. General: Comply with instructions and recommendations of manufacturer and as herein specified.

B. Deliver materials to project site in original packages containers clearly labeled to identify manufacturer, brand name, quality or grade, and fire hazard classification.

C. Store materials in original undamaged packages or containers. Do not store rolled goods in upright position. Maintain temperature in storage area above 40 degrees F (4 degrees C).

1.6 JOB CONDITIONS:

A. Maintain constant minimum temperature of 60 degrees F (16 degrees C) at areas of installation for at least 72 hours before and 48 hours after application of materials.

B. Illuminate areas of installation using buildings permanent lighting system, temporary lighting alone will not be acceptable.

2. PRODUCTS

2.1 VINYL COATED FABRIC TACKABLE WALL PANELS (VFTW), (VFTW-F)

A. General comply with manufacturer's specifications and installation recommendations.

B. Manufacturer

1. Koroseal School Collection: as manufactured by one of the following:

a. Chatfield Clarke Co. (909) 823-4297 www.chatfield-clarke.com
b. Lamvin Inc. (760) 806-6400 www.lamvin.com
c. Tri-Best Visual Display (909) 980-9802 www.tri-best.com
d. ABC School Equipment (951) 817-2200 www.pvsusa.com
e. Claridge Products Solutions (510) 351-8183 www.claridgeproducts.com

2. Size: ½" x 4' - 8'-0", 9'-0", 10'-0" or 12'-0".
3. Backing: ½" Calendered Clay Coated Wood Fiber Panels (www.bpcan.com) (Factory installed).
4. Vinyl (Class A per 2016 CBC Section 803.7): 18 oz Koroseal Harborweave II School Collection; #2121-14 Winter Mist.

2.2 ACCESSORY ITEMS:

A. Adhesives: Provide manufacturer's recommended adhesive, primer, and sealer, produced expressly for use with selected wall coverings on substrate as shown on drawings. Provide materials which are mildew resistant and nonstaining to wall covering.

B. Trim: Provide manufacturer's recommended vinyl-covered trim as shown on the drawings.

3. EXECUTION

3.1 PREPARATION:

A. Acclimatize wall covering materials by removing from packaging in area of installation not less than 24 hours before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures in areas where wall covering is to be applied.

C. Test substrate with electronic moisture meter to verify that surfaces to be covered do not exceed 4% moisture content.

3.2 INSTALLATION:

A. Vinyl Coated Fabric Tackle Wall Panels

1. General:

a. Conditioning Vinyl Tackboard: all packages or stacks shall be opened and the Vinyl Tackboard placed around the room for at least 24 hours before application.

b. Base Wall: It is recommended that Vinyl Tackboard be installed over a solid backing, such as gypsum, wallboard or plywood. Surfaces shall be clean and dry. Vinyl Tackboard shall not be applied over open framing members.

c. Adhesive Application: To the back side of each piece of Vinyl Tackboard, apply adhesive by either of following methods:

1. Notched Trowel: Apply adhesive in 4" wide ribbons along the edges and down the middle using a notched trowel with 1/4" deep notches spaced ½" o.c.

2. Cartridge: Apply adhesive in continuous ¼" to 3/8" beads starting at one edge of the board and 16" o.c.

d. Vinyl Tackboard Application

1. Place tackboard vertically against the base of the wall and hold a maximum of ½" off the plywood rubber base backer as shown on the drawings. Fasten each board with 6d nails spaced 8" o.c. along the top and bottom of each sheet or as detailed. Clean off any adhesive from vinyl surface immediately with mild soap and water.

2. Install trim where shown on the drawings per the manufacturer's written instructions.

2. Where wrapped beveled edge tackboard is used, temporary bracing must be used to assure contact between the base wall and the tackboard until the adhesive is set (4 to 6 hours).

3.3 ADJUST AND CLEAN:

A. Replace removed plates and fixtures; verify cut edges of wall coverings are completely concealed.

B. Remove surplus materials, rubbish, and debris resulting wall covering installation upon completion of work, and leave areas of installation in neat, clean condition.

3.4 EXTRA STOCK: Deliver stock of maintenance material to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

A. Vinyl Coated Tackable Wall Covering: Furnish quantity of full size units equal to 1% of amount installed.

B. Trim: Furnish quantity of full length of each type of vinyl-covered trim equal to not less than 1% of amount installed.

**END OF SECTION 10 11 23**

# SECTION 10 14 00 – SIGNAGE AND GRAPHICS

1. GENERAL:

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –01 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Accessibility Signs meeting the requirements of Title 24 California Accessibility Standards and the Americans with Disabilities Act. Signs required in this project are as follows and are shown on the drawings:

1. Room Identification Signs
2. Toilet Room Door Symbols
3. Exterior Entrance Sign
4. Assistive Listening System Sign
5. Tactile Exit Signs
6. International Symbol of Accessibility Sign

B. Parking Lot Accessibility Signs meeting the requirements of Title 24 California Accessibility Standards and the Americans with Disabilities Act. Signs required in this project are as follows and are shown on the drawings:

1. “Tow Away” Sign
2. Accessible Parking Space Sign
3. Van Accessible Parking Space Sign

C. Room Capacity Signs

D. Applied Letters and Numbers

1.3 QUALITY ASSURANCE:

A. Manufacturer’s Data: Provide complete manufacturer’s data, including installation instructions and details to contractor’s job Superintendent, to facilitate coordination of work.

B. All Signage must be field inspected after installation per CBC 11B-703.1.1.2.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer’s descriptive literature and specifications, including color samples of materials for applicable approval.

B. Samples: Submit full size sample sign of each type, style, and color specified including method of attachment.

C. Shop Drawings: Submit shop drawings showing sign styles, compliance with California Title 24 Accessibility Standards (where applicable), lettering, locations, and overall dimensions.

D. Certification: Submit manufacturer’s certification that all signs furnished for project comply with requirements specified herein.

2. PRODUCTS:

2.1 ACCESSIBILITY SIGNS:

A. Signs shall be as shown and detailed on the drawings.

B. PLAQUE MATERIAL:

1. One piece Melamine plastic laminate with a color contrasting core. Added-on and/or engraved characters are unacceptable.

2. Non-static, fire-retardant, and self-extinguishing.

3. Impervious to most acids, alkalies, alcohol, solvents, abrasives, and boiling water.

C. RAISED (TACTILE) LETTERS AND NUMBERS:

1. Sans-serif uppercase characters

2. Horizontal format

3. Raised 1/32” from sign plate face

4. 5/8” (min.) to 2" (maximum) high based on the height of the uppercase letter “I”.

5. Character proportions shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.

6. Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.

7. Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8 inch minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch minimum and 4 times the raised character stroke width maximum at the base of the cross section, and 1/8 inch minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch minimum.

8. Line spacing: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

9. Raised characters shall be duplicated in Braille complying with the following requirements.

D. CALIFORNIA CONTRACTED GRADE 2 BRAILLE:

1. Domed or rounded shape.

2. Indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns, and names, individual letters or the alphabet, initials, or acronyms.

3. Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8 inch (minimum) and 1/2 inch (maximum) from any other tactile characters and 3/8 inch (minimum) from raised borders and decorative elements.

4. Dot base diameter: 0.059 inches (minimum) to 0.063 inches (maximum).

5. Distance between two dots in the same cell (measured center to center): 0.100 inches.
6. Distance between corresponding dots in adjacent cells (measured center to center): 0.300 inches.
7. Dot height: 0.025 inches (minimum) to 0.037 inches (maximum).
8. Distance between corresponding dots from one cell directly below (measured center to center): 0.395 inches (minimum) to 0.400 inches (maximum).

E. COLOR/FINISH:

1. Color of signs shall match signs already on site and as indicated in the approved drawings.
2. Finish shall be non-glare.

F. DECORATIVE LOGO:

1. Digitally print decorative logo shown on sign details in drawings directly to the surface of the sign with UV Flatbed Direct Print Technology.

2.2 ROOM CAPACITY SIGNS:

A. Signs shall be 18” wide x 6” high x 1/8” thick

B. Signs shall have the following characteristics:

1. Characters shall be raised 1/32” from sign plate face.
2. Signs shall be of one-piece construction; added-on and/or engraved characters are unacceptable.
3. Wording for the sign is shown on the drawings.
4. Sign shall have a ½” outside radius at corners
5. All characters shall contrast with their background – either light characters on a dark background or dark characters on a light background. Characters and background shall have a matte finish.

C. PLAQUE MATERIAL:

1. Melamine plastic laminate with a color contrasting core.
2. Non-static, fire-retardant, and self-extinguishing.
3. Impervious to most acids, alkalies, alcohol, solvents, abrasives, and boiling water.

D. LETTERS AND NUMBERS:

1. Sans-serif uppercase characters
2. Characters shall be beveled
3. 1/2” (min.) high
4. Width-to-height ratio between 3:5 and 1:1
5. Stoke width-to-height ratio between 1:10 and 1:5
6. Character spacing shall be 1/8” (min.) to 3/8” (max.) between two adjacent characters measured at top surface.

E. COLOR:

1. Color of signs shall be selected by architect from the manufacturer's standard color palette.

2.3 PARKING LOT ACCESSIBILITY SIGNS:

A. Signs shall be as shown and detailed on the drawings.

B. Material: 14 gauge (min.) galvanized steel

C. Text on sign shall be black capital sans serif letters on white baked enameled background. Size of letters shall be as shown on the drawings.

D. White reflectorized International Symbol of Accessibility where shown on sign details on drawings shall be 6" high (min.) on a light blue porcelain background. Blue will be equal to Color No. 15090 per Federal Standard 595B.

2.4 APPLIED LETTERS AND NUMBERS:

A. Manufacturer: Gemini Incorporated
103 Mensing Way
Cannon Falls, MN 55009
(800) 538-8377
www.signletters.com

B. Style: Standard Cast Metal Letters

C. Material: Cast Aluminum.

D. Size: Shown on Drawings

E. Font: Uppercase Helvetica Font

E. Hardware: 3" long metal threaded studs

F. Text and Location as shown on drawings

G. Color of letters and numbers shall be selected by architect from the manufacturer's standard color palette.

3. EXECUTION

3.1 GENERAL

A. Field Conditions: Inspect field condition for suitability of proper installation. Inform contractor of conditions requiring attention.

3.2 INSTALLATION

A. Locate sign units where indicated on drawings, using mounting methods of the type described and in compliance with manufacturer's instructions and as indicated on drawings.

B. Install signs level, plumb, and at heights indicated on drawings.

C. Attach and secure signs to walls, doors, poles, fences, or glass with appropriate screws and adhesives or as indicated on drawings.

**END OF SECTION 10 14 00**

# SECTION **10 21 13** - **TOILET COMPARTMENTS**

## 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. Solid-polymer toilet compartments configured as toilet enclosures.

### 1.3 SUBMITTALS

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

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of centerlines of toilet fixtures.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

D. Product Certificates: For each type of toilet compartment, from manufacturer.

E. Independent lab test reports indicating compliance with NFPA 286.

F. Maintenance Data: For toilet compartments to include in maintenance manuals.

### 1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 75 or less.
   2. Smoke-Developed Index: 450 or less.

B. HDPE Materials shall be tested in accordance with NFPA 286 and shall comply with the acceptance criteria listed in CCR Title 24 Part 2, California Building Code Section 803.1.2.1.

C. Regulatory Requirements: Comply with applicable provisions in CCR Title 24, Part 2, California Building Code - Accessibility Standards as enforced by DSA for toilet compartments designated as accessible.

### 1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221.

C. Brass Castings: ASTM B 584.

D. Brass Extrusions: ASTM B 455.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

F. Stainless-Steel Castings: ASTM A 743/A 743M.

G. Zamac: ASTM B 86, commercial zinc-alloy die castings.

H. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Santana Products, Inc.
2. Comtec Industries.
3. Capitol Partitions.
4. Accutec Manufacturing.
5. Laminating Technologies
6. Global Steel Products Corp.

B. Toilet-Enclosure Style: Overhead braced.

C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
2. Side panel of Accessible Toilet Compartment for Children Use: Provide a toe clearance of 12 inches minimum above finish floor and 6 inches deep beyond the compartment-side face of the partition, exclusive of partition support members. Partition components at toe clearance shall be smooth without sharp edges or abrasive surfaces.
3. Color and Pattern: Paisley (black with white specks or flakes).

D. Pilaster Shoes: Manufacturer's standard design (modified as required to insure that height of shoe covers screw heads at low point of floors); stainless steel.

E. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Manufacturer's standard chrome plated non-ferrous metal, clear anodized aluminum or stainless steel.
   2. Hinges: Manufacturer's standard continuous, spring-loaded or gravity type, adjustable to return to a closed position.
   3. Slide latch and Keeper: Manufacturer's standard surface-mounted slide latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mounting height between 34 inches and 44 inches above finish floor. Coordinate location with Door Pull.
   4. Coat Hook at 48 inches above finish floor: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
   5. Door Pull: Manufacturer's standard U-pull units on both sides of doors between 34 inches and 44 inches above finish floor set immediately below the Slide latch and Keeper.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel with theft-resistant-type heads. Provide stainless steel sex-type bolts for through-bolt applications. All toilet compartment doors shall be through bolted to the hinges and the hinges to the pilasters with stainless steel sex-bolts. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments. Doors at side entry accessible stalls shall be in-swinging and shall have 34 inch minimum clear opening width when the door is open 90 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions as submitted to and approved by Architect. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices and as detailed on the drawings.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster

with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on accessible toilet stall doors to return doors to fully closed position.

**END OF SECTION 10 21 13**

# SECTION **10 26 00** - **WALL PROTECTION**

## 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. Corner and end wall guards.

### 1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Corner and End-Wall Guards: 12 inches long.

### 1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

### 1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of materials beyond normal use.
   2. Warranty Period: Lifetime of the Building.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards <Insert drawing designation>: Fabricated from one-piece, formed or extruded metal with formed edges; with 90-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide IPC Door and Wall Protection Systems: Division of InPro Corporation; Stainless Steel Flush Mount Corner Guard or comparable product by one of the following:
a. Alpar Architectural Products, LLC.
b. Arden Architectural Specialties, Inc.
c. Korogard Wall Protection Systems; a division of RJF International Corporation.
d. TheCornerGuardStore.
e. WallGuard.com.
2. Material: Stainless steel, Type 304.
a. Thickness: Minimum 16 gauge.
b. Finish: Directional satin, No. 4.
3. Wing Size: As indicated on approved drawings.
4. Corner Radius: 1/8 inch.
5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.3 END-WALL GUARDS

A. Surface-Mounted, Metal, End-Wall Guards <Insert drawing designation>: Fabricated from one-piece, formed or extruded metal that covers entire end of wall; with formed edges.
1. Basis-of-Design Product: Subject to compliance with requirements, provide IPC Door and Wall Protection Systems: Division of InPro Corporation; Stainless Steel Flush Mount End Wall or comparable product by one of the following:
a. TheCornerGuardStore.
b. WallGuard.com.
2. Material: Stainless steel, Type 304.
a. Thickness: Minimum 16 gauge.
b. Finish: Directional satin, No. 4.
3. Wing Size: Nominal 3 inches. Refer to approved drawings for additional information
4. Corner Radius: 1/8 inch.
5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.4 FABRICATION

A. Fabricate corner and end-wall guards to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

2.5 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Remove tool and die marks and stretch lines, or blend into finish.
2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
3. Run grain of directional finishes with long dimension of each piece.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which corner and end-wall guards will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

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

3.2 INSTALLATION

A. General: Install corner and end-wall guards level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

**END OF SECTION 10 26 00**

# SECTION **10 44 13** - **FIRE EXTINGUISHER CABINETS**

## 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. Fire extinguisher cabinets for the following:
      a. Portable fire extinguishers.

B. Related Sections:
   1. Section 10 44 16 "Fire Extinguishers."

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
   1. Fire Extinguisher Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire extinguisher cabinets to include in maintenance manuals.

### 1.4 COORDINATION

A. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire extinguisher cabinets with wall depths.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B.

B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE EXTINGUISHER CABINET

A. Cabinet Type: Suitable for fire extinguisher.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. J. L. Industries, Inc., a division of Activar Construction Products Group; Ambassador Series.
b. Larsen's Manufacturing Company; Architectural Series.
c. Potter Roemer LLC; 1700 Series.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Steel sheet.
1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Acrylic sheet.
1. Acrylic Sheet Color: Clear transparent acrylic sheet.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting lever handle with cam-action latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
1) Location: Applied to cabinet glazing.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:

a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
b. Interior of cabinet and door.

2.3 FABRICATION

A. Fire Extinguisher Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire extinguisher cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire extinguisher cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

## 3.2 PREPARATION

A. Prepare recesses for semirecessed fire extinguisher cabinets as required by type and size of cabinet and trim style.

## 3.3 INSTALLATION

A. General: Install fire extinguisher cabinets in locations and at mounting heights indicated.

B. Fire Extinguisher Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

C. Identification: Apply vinyl lettering at locations indicated.

## 3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire extinguisher cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire extinguisher cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire extinguisher cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire extinguisher cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire extinguisher cabinet and mounting bracket manufacturers.

E. Replace fire extinguisher cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 10 44 13**

# SECTION **10 44 16** - **FIRE EXTINGUISHERS**

## 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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Sections:
   1. Section 10 44 13 "Fire Extinguisher Cabinets."

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

C. Warranty: Sample of special warranty.

D. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

### 1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

### 1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

### 1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
      b. Larsen's Manufacturing Company.
      c. Potter Roemer LLC.
   2. Valves: Manufacturer's standard.
   3. Handles and Levers: Manufacturer's standard.
   4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A:40-B:C, 5-lb and 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container. **See floor plans for locations of each size used**.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
      b. Larsen's Manufacturing Company.
      c. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
   1. Mounting Brackets: 48 inches above finished floor to top of fire extinguisher handle.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated per details shown on drawings.

**END OF SECTION 10 44 16**

# SECTION 11 52 13 - PROJECTION SCREENS

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. Manually operated, front-projection screens.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for metal support framing for front-projection screens.

1.3 DEFINITIONS

A. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

B. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:
1. Drop lengths.
2. Anchorage details, including connection to supporting structure for suspended units.
3. Details of juncture of exposed surfaces with adjacent finishes.
4. Accessories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install front-projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 MANUALLY OPERATED, FRONT-PROJECTION SCREENS

A. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
   1. Screen Mounting: Top edge securely anchored to a 3-inch- diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.

B. Surface-Mounted, Metal-Encased, Manually Operated Screens without Tab Tensioning: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than 0.027 inch thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with matching end caps and concealed mounting.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Da-Lite Screen Company; Model C with CSR.
      b. Draper Inc; Luma 2 with AutoReturn.

2.3 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain of not less than 0.9, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Da-Lite Screen Company; Matte White.
      b. Draper Inc; Matte White.

B. Material: Vinyl-coated, glass-fiber fabric or vinyl sheet.

C. Mildew-Resistance Rating: Zero or 1 when tested according to ASTM G 21.

D. Flame Resistance: Passes NFPA 701.

E. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.

F. Seamless Construction: Provide screens, in sizes indicated, without seams.

G. Edge Treatment: Black masking borders.

H. Size of Viewing Surface: 60 inches high by 96 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
   1. Test manually operated units to verify that screen-operating components are in optimum functioning condition.
   2.

END OF SECTION 11 52 13

# SECTION 11 68 00 - PLAY FIELD EQUIPMENT AND STRUCTURES

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 playground equipment as follows:

1. Composite playground equipment.

1.3 DEFINITIONS

A. Definitions in ASTM F 1487 apply to Work of this Section.

B. IPEMA: International Play Equipment Manufacturers Association.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of playground equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 32 18 16.13 "Playground Protective Surfacing."

C. Samples for Initial Selection: For each type of exposed finish.

1. Manufacturer's color charts.
2. Include Samples of accessories involving color selection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Certificates: For each type of playground equipment.

C. Material Certificates: For the following items:

1. Shop finishes.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.

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

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain playground equipment from single source from single manufacturer.

B. Playground equipment and components shall have the IPEMA Certification Seal.

2.2 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F 1487.

2.3 COMPOSITE PLAYGROUND EQUIPMENT

A. Composite Play Structure: Integral play assembly that provides more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.

1. Metal Frame: Galvanized-steel pipe or tubing connected with bolts.

a. Main Frame Posts: Not less than 3 ½’ OD.
b. Color: As selected by Architect from manufacturer's full range.

2. Platforms: Perforated metal.

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

3. Roofs: Plastic.

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

4. Play Structure Access Component(s): Ladder, Stairs and Accessible transfer platform

   a. Handholds: Guardrails on each side.

5. Equipment: Include the following play event components:

   a. Activity panel.
   b. Bridge.
   c. Climber: Pole.
   d. Slide.
   e. Colors: As selected by Architect from manufacturer's full range.

6. Arrangement: As indicated on Drawings.
7. Capacity: 20 users.
8. Age Appropriateness: Five through 12 years.

2.4 FABRICATION

A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from perforated or expanded metal made into floor units with slip-resistant finish. Fabricate units in modular sizes and shapes to form assembled play surfaces indicated.

D. Protective Barriers: Fabricate according to ASTM F 1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from the following:

   1. Welded-metal pipe or tubing with vertical bars.

E. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.

F. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches of 0.125 inch.

   1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F 1487.

G. Roofs and Canopies: Designed to discourage and minimize climbing by users.

   1. Fabricated from opaque plastic.

H. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to freestanding, upright support posts or directly to playground equipment.

1. Text: Minimum informational content according to ASTM F 1487.
2. Colors: Selected by Architect from manufacturer’s full range.

2.5 MATERIALS

A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated.

C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.

D. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.

E. Iron Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.

F. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

G. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105-inch-.

H. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.

I. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

2.6 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for normal-weight, air-entrained concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch- maximum-size aggregate.

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils , medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.8 IRON AND STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils . Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.

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

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.

1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
3. Finishing Footings: Smooth top, and shape to shed water.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Perform inspection and testing for each type of installed playground equipment according to ASTM F 1487.

B. Playground equipment items will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

D. Notify Architect and Owner 48 hours in advance of date(s) and time(s) of testing and inspection.

**END OF SECTION 11 68 00**

# SECTION **12 93 00** - **SITE FURNISHINGS**

## 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. Picnic Style Tables.
2. Bicycle racks.
3. Skateboard racks
4. Bicycle lockers.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 PICNIC STYLE TABLES

A. Products: Subject to compliance with requirements, provide the following:
1. Webcoat, Inc.; UltraLeisure Series Rectangular Tables; T8ULPERF.

B. Frame: Steel– 2 3/8 inch O.D.

C. 1. Feature: Surface Mount Clamp.

D. Seat:
1. Material:
   a. PVC-color coated Steel: 11 gauge perforated metal.
2. Seat Height: 18 inches.
3. Seat Surface Shape: Flat.
4. Width: 8’-0”.
5. Depth: 12 inches.
6. Seating Configuration: Rectangular seat on each long side.
   a. Straight shape.

E. Table Top:
1. Material:
   a. PVC-color coated Steel: 11 gauge perforated metal.
2. Table Height: 30 inches

3. Table Surface Shape: Flat
4. Length: 8’-0”
5. Width: 3’-0”
6. Surface Shape: Rectangular.
7. Feature: Center umbrella hole.

F. Steel Finish: Galvanized and PVC-color coated.
1. Color: As selected by Architect from manufacturer's full range.

2.2 PICNIC STYLE TABLES - ACCESSIBLE

A. Products: Subject to compliance with requirements, provide the following:
1. Webcoat, Inc.; UltraLeisure Series Rectangular Tables; T8ULPERFHDCPALT.

B. Frame: Steel – 2 3/8 inch O.D.

C. 1. Feature: Surface Mount Clamp.

D. Seat:
1. Material:
a. Steel: 11 gauge perforated metal.
2. Seat Height: 18 inches.
3. Seat Surface Shape: Flat.
4. Width: 6’-0”.
5. Depth: 12 inches.
6. Seating Configuration: Rectangular seat centered on each long side.
a. Straight shape.

E. Table Top:
1. Material:
a. PVC-color coated Steel: 11 gauge perforated metal.
2. Table Height: 30 inches (27 inches clear beneath table top)
3. Table Surface Shape: Flat
4. Length: 8’-0”
5. Width: 3’-0”
6. Surface Shape: Rectangular.
7. Feature: Center umbrella hole.

F. Steel Finish: Galvanized and PVC-color coated.
1. Color: As selected by Architect from manufacturer's full range.

2.3 BICYCLE RACKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **The Wagner Companies; SR9G** or comparable product by one of the following:
1. A A A Ribbon Rack Co., Inc.; Division of Brandir International, Inc.
2. American Bicycle Security Company.
3. Columbia Cascade Company.
4. Creative Pipe, Inc.
5. Dero Bike Rack Co.
6. Huntco Supply, LLC.
7. L. A. Steelcraft.
8. Madrax; Division of Graber Manufacturing, Inc.
9. Victor Stanley, Inc.
10. Wausau Tile, Inc.

B. Bicycle Rack Construction:
1. Frame: Galvanized steel.
   a. Pipe OD: Not less than 2-3/8 inches.
2. Style: Double-side parking.
   a. Overall Height: 42 inches.
   b. Overall Width: 108 inches.
   c. Capacity: Designed to accommodate no fewer than nine bicycles.
3. Security: Designed to lock wheel and frame.
4. Installation Method: Cast in concrete.

C. Steel Finish: Galvanized.

2.4 SKATEBOARD RACKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Ground Control Systems; Skatedock Surface Mount 10X-SM10X** or comparable product by one of the following:
1. Architect and School District approved equal.

B. Bicycle Rack Construction:
1. Frame: Steel Plate.
   a. Triangular Shape
   b. Molded Urethane Edge Guards.
2. Top Shelf: Composite PE
3. Locking Rings: Galvanized steel.
   a. Pipe OD: Not less than 4 inches.
4. Style: Horizontal Stacking.
   a. Overall Height: 72 inches.
   b. Overall Width: 13 inches at base and 18 inches at top.
   c. Capacity: Designed to accommodate no fewer than 10 skateboards.
5. Security: Locking Steel Rings.
6. Installation Method: Surface Mount to Concrete.

C. Steel Finish: DuraPlas Silver – Standard (Marine Environment Rated)

2.5 BICYCLE LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Hannan Specialties Inc.; Dura Bike Locker, DL2** or comparable product by one of the following:
1. Cora Bike Rack.
2. Creative Pipe, Inc.
3. Huntco Supply, LLC.
4. Madrax; Division of Graber Manufacturing, Inc.

B. Bicycle Locker Construction:
1. Locker:
   a. Exterior Walls, Tops and Doors: 16 gauge (min.) galvanized steel sheet.
   b. Divider Wall: 18 gauge (min.) galvanized steel sheet.
   c. Frame: 14 gauge (min.) galvanized steel sheet.
2. View Grille: Perforated metal.
3. Lock: Heavy Duty pop-out “T” key lock with internal locking bar.
   a. Provide four keys for each lock and a master key.
4. Overall Height: 48 inches.
5. Overall Width: 39 inches.
6. Overall Depth: 75 inches.
7. Capacity: Designed to accommodate two bicycle(s).

8. Installation Method: Locker anchored at finished grade to substrate indicated on the approved drawings.
9. Locker Configuration: Multiple units as indicated on approved drawings, in straight row.

C. Steel Finish: TGIC Polyester Powder Coating.
1. Color: Mesa Tan.

2.6 MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Steel and Iron: Free of surface blemishes and complying with the following:
1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
6. Perforated Metal: From steel sheet not less than 0.120-inch nominal thickness; manufacturer's standard perforation pattern.

C. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
1. Polyethylene: Fabricated from virgin plastic HDPE resin.

D. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality.
1. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; extent as indicated on Drawings.

E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.

F. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

G. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
1. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.7 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed

connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.8 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations and methods indicated on approved Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set

plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 12 93 00

SECTION **13281**, **LEAD-BASED PAINT**

## 1.01 GUIDELINES AND /OR SPECIFICATIONS

**A.** These guidelines or specifications are provided for, and shall be followed by, the Contractor to minimize and control potential lead hazards during surface preparation or component removal. No testing was conducted to determine lead concentrations on building surfaces. All painted surfaces on this project are assumed to contain various concentrations of lead; therefore, Cal/OSHA regulations apply during disturbance of any painted surface.

**B.** No Contractor shall begin work which will impact painted surfaces in a manner which will either expose a worker to possible lead containing dust or create possible lead containing waste, until all required pre-construction documentation has been reviewed and written approval from the School District has been received. Any Contractor observed conducting such activities without having written approval from the School District will be instructed to stop work. Work will not be allowed to resume until the aforementioned approval has been received by the Contractor.

## 1.02 DEFINITIONS OF LEAD-BASED PAINT (LBP)

**A.** The various definitions of LBP should be discussed first to assist in the interpretation of the requirements that follow.

1. Housing and Urban Development (HUD) Guidelines
   Definition HUD defines LBP as "any varnish, paint, stain or other applied coating that has 1 $mg/cm^2$ (or 5,000 ug/g by dry weight) or more of lead." The terms "leaded paint" and "lead-containing paint" are synonymous with "lead-based paint". 5,000 ug/g is equivalent to 5,000 parts per million (ppm), and equivalent to 0.50% by weight.

2. Consumer Products Safety Commission (CPSC) Definition
   In 1978, the CPSC defined lead-paint as that having greater than 0.06% (600 ppm), with restrictions of use for residential housing, toys, and furniture.

3. California Occupational Safety and Health Administration (Cal/OSHA) Currently, Cal/OSHA has not established a definition for LBP, nor have they established minimum concentrations where their regulations do not apply. Cal/OSHA regulates all construction activities involving materials containing lead, including LBP. These regulations are found in Title 8 Section 1532.1. Since Cal/OSHA has not established a concentration of lead in paint where their regulations do not apply, any disturbance to products containing lead come under the jurisdiction of Cal/OSHA requirements.

## 1.03 REQUIREMENTS AND PROCEDURES

**A.** The following requirements and procedures shall apply during disturbance of any painted surfaces:

1. For this project, all workers who will significantly disturb painted surfaces are required to be Department of Health Services (DHS) “Certified Lead Workers”, and the Supervisor of the project is required to be a DHS “Certified Lead Supervisor”. Workers and Supervisors who are currently DHS “Interim Certified Lead Workers” or “Interim Certified Lead Supervisors”, are acceptable to perform work on this project.

2. Any worker who has received training and is in the process of being certified may submit for review a copy of an application to DHS for that certification. For this application to be considered, it must include completed and legible copies of:

    a. Application for lead-related construction certification/interim certification (2 pages) properly signed by the applicant.
    b. An accredited DHS Course Completion Form.
    c. Copy of method of payment to DHS required to accompany a valid application request.

3. The Contractor shall have a competent person (as defined by Cal/OSHA) onsite at all times to supervise and oversee all activities which may disturb LBP, or are considered to be “Trigger Tasks” by Cal/OSHA. “Trigger Tasks” include, but are not limited to, manual demolition, scraping and sanding, using heat guns, using HEPA equipment, abrasive blasting, welding, cutting, torch burning, and LBP debris clean-up.

**B.** Preparation of the work area at the school site must be completed using 6-mil polyethylene (poly) sheeting placed over floors, asphalt, concrete, soil, vegetation, and other surfaces in the immediate work area.

**C.** For exterior work site preparation, one layer of 6-mil poly sheeting should be placed on the ground extending at least 10 feet beyond the perimeter of surfaces included in the work. Do not anchor ladder feet on top of plastic (puncture the plastic to anchor ladders securely to ground). For all other exterior painted surfaces, protect the poly sheeting with boards to prevent puncture from falling debris, nails, etc., if necessary. Raise edges of the plastic to create a catch basin to prevent contaminated runoff. Secure the plastic to the side of the building with tape or on other anchoring system so there is no gap between the plastic and the building. Weight all plastic sheets down using wooden two-by-fours or similar objects. Keep all windows within 20 feet of working surfaces closed, including windows of adjacent structures.

**D.** For interior work site preparation, two layers of 6-mil poly sheeting must be placed on the entire floor. The poly sheeting must be secured to the floor using tape so there is no gap between the floor and the wall. If individual rooms are being worked in, seal all doorways with a primitive airlock flap to prevent contamination of other areas of the building. Post Lead Warning Signs at the building exterior near main and all secondary entry ways. All ventilation systems are to be turned off and sealed with poly sheeting. If furniture or other equipment is to remain in place, cover with a single layer of poly sheeting. All cleanup of the work area shall be performed using a HEPA vacuum and wet washing techniques.

**E.** Erect barrier tape at a 20-foot perimeter around the working surfaces to prevent other people from entering the work area. Post Lead Warning Signs at the 20-foot perimeter.

**F.** Do not conduct exterior work if wind speeds are greater than 20 miles per hour. Work must stop and cleanup occur before rain begins.

**G.** Do not leave debris or poly sheeting out overnight if work is not completed. Keep all debris in a secured area until final disposal.

**H.** Waste disposal of all materials is the responsibility of the Contractor. Careful planning of the work shall be made to minimize hazardous waste generated during the painting operation. Separation of waste streams is necessary, particularly separation of any loose paint chips or flakes from other construction debris. All waste streams must be identified by the Contractor before the work begins and separated during the course of the project to minimize costs of disposal.

**I.** Prior to disposal of waste products such as sand, paint chips, vacuum debris, and filters generated during LBP surface preparation activities as non-hazardous, the Contractor must conduct appropriate waste stream characterization testing. Once completed, the test analysis results must be submitted to School District for review. The Contractor may not remove or dispose of the identified materials from the job site until this review has been completed and the Contractor has been informed by School District of their concurrence that the materials have been properly tested, and meet the requirements allowing the materials to be classified as non-hazardous. This process does not apply to any waste assumed or determined to meet levels of lead requiring the waste to be disposed of as hazardous waste.

**J.** The Contractor **SHALL NOT** sign any Hazardous Waste Manifests for the School District. It shall be the responsibility of the Contractor to notify the School District and coordinate having any manifest properly signed by a District representative.

**K.** Personal protective equipment is required by the Contractor in accordance with Cal/OSHA regulations Title 8 Section 1532.1, including respiratory protection. At a minimum, half-face respirators with HEPA cartridges would be required during surface preparation, where there is manual scraping or sanding. If only water washing of the surfaces is performed, respiratory protection would not be required.

**L.** The Contractors are required to comply with all regulations in Title 8 Section 1532.1 Lead in Construction, Cal/EPA Title 22 for waste classification and disposal, and US EPA for lead work.

**M.** The following work activities are prohibited on the project:

1. Open-flame burning or torching.
2. Machine sanding or grinding without a HEPA vacuum exhaust tool.
3. Uncontained hydro-blasting or high-pressure washing.
4. Abrasive blasting or sandblasting without a HEPA vacuum exhaust tool and outside of a negative pressure enclosure.
5. Heat guns operating above 1,100 □F.
6. Dry scraping (except for limited areas).
7. Use of methylene chloride based paint strippers.

**N.** If scraping or sanding is to be performed, only wet scraping or wet sanding will be allowed, unless HEPA systems are used in conjunction with the operation.

**O.** Where abrasive blasting is performed by the Contractor, a negative pressure enclosure must be constructed using at minimum 6 mil thick poly sheeting. The Contractor shall utilize “negative air machines”, “hogs”, and “air filtration units”, to establish a negative pressure within the work area. Sufficient make-up air ports shall be installed with flapped openings and pre-filters to assist in providing outside air for dilution of airborne particulate.

The integrity of the negative pressure enclosure shall be maintained at all times during the abrasive blasting work to prevent fugitive emissions.

**P.** A written compliance plan must be provided to the School District and include the following:

1. A description of equipment and materials, controls, crew size, job responsibilities, and operations and maintenance procedures for each activity in which lead is disturbed and potentially emitted.

2. A description of specific control methods (wet methods, engineering controls, etc.).

3. Technology considered in meeting the Cal/OSHA permissible exposure limit (PEL).

4. Air monitoring data documenting sources of lead emissions.

5. A detailed implementation schedule for the compliance plan, including the schedule for inspections by a competent person.

6. A description of the lead work practice program which will be used to control worker exposures. This includes the use of protective work clothing, equipment, hygiene facilities and practices, and housekeeping practices.

7. A description of arrangements made among contractors on multi-contractor work sites to inform affected employees (including bystanders) of potential lead exposures, and to clarify responsibilities with regard to control of those exposures.

NOTE: If the Contractor is found conducting lead related work not specifically mentioned and described in the compliance plan, the work will be stopped until a compliance plan including that work is submitted, reviewed, and approved by the School District.

**Q.** The Contractor is responsible for conducting personal air monitoring during disturbance of LBP to evaluate airborne exposures during performance of any work listed as a “Trigger Task”. This sampling shall be in accordance with Cal/OSHA regulations found in Title 8 Section 1532.1, in order to determine worker exposure to lead and evaluate the effectiveness of the Contractor’s “Compliance Work Plan”.

Sample information must include (but is not restricted to) the individual’s name wearing the sample, that individual’s Social Security Number, date the sample was collected, identification by unique method of the area where the work is being performed, and identifying the work being performed. EXAMPLE: James Black, 444-22-555, 10/10/99, Bill Jackson Elementary School, Building H, Classroom 5, East covered walkway. Laboratory results shall be provided to School District within 72 hours of sample collection.

**R.** All HEPA equipped vacuums and pressure differential units to be used on this project during LBP operations shall be tested and meet ANSI Z9.2 requirements using DOP or an equivalent testing agent. This testing must take place within 10 calendar days prior to their use and after replacement of any HEPA filter removed from previously tested equipment. Copies of all certifications must be provided to the School District prior to use of the equipment.

**S.** The Contractor shall submit to the School District copies of recent (performed within the previous 12 months or less) blood sampling and analysis test results of lead (BLL) and zinc protoporphyrin (ZPP) levels for all workers who will be performing any “Trigger Tasks” with regards to LBP as outlined earlier in this specification.

**T.** The Contractor shall submit to the School District copies of medical evaluations and respiratory fit test records received within the last 12 months. The Contractor is responsible for maintaining current documents and resubmitting copies to the School District for any worker whose documents expire during the project. Any worker observed on a job site which either is not approved to conduct work by the School District or has been approved but documentation pertaining to training, medical evaluation, or respiratory fit testing has expired will be instructed to stop work until these documents are received by the School District and the worker is approved to perform LBP related work.

**U.** Decontamination procedures shall be established by the Contractor depending upon the airborne concentrations of lead, and shall include requirements for change rooms, showers, eating facilities, and hand washing.

**V.** Prior to whole building components being removed, loose peeling and flaking paint must first be either removed from the component surfaces or stabilized. Any paint flakes generated during this work must be separated into appropriate waste streams and handled as a hazardous waste, or as deemed appropriate based on results of proper analytical testing results.

**W.** The Contractor shall document daily activities performed which are classified as “Trigger Tasks”. This information recorded must include (but not be restricted to) the name(s) of all workers performing the tasks and their Social Security Number, date of the work activity, location of work, and identifying the work being performed. EXAMPLE: James Black, 444-22-555, 10/10/99, Bill Jackson Elementary School, Building H, Classroom 5, East covered walkway, wet sanding of cabinets, walls, trim, etc. Copies of these documents will be submitted to the School District every 10 working days for review.

**X.** These specifications shall apply to all work related to preparation of all painted surfaces and to whole building component replacement which are painted. Refer to Section 09900-Painting for additional requirements related to surface preparation. The following documents shall be provided to the School District prior to work.

## LEAD-RELATED WORK BID SUBMITTALS

**Required for General Contractor Performing Surface Preparation Painting Activities**

1.____ Current Training Records for Lead

a.____ Lead-Related Construction Certification/Interim Certification by DHS, or

____ Copy of Application for Lead Certification/Interim Certification to DHS

b.____ At least one Supervisor must be included in documentation submitted for A

## LEAD-RELATED WORK PRE-CONSTRUCTION SUBMITTALS

2. ____ Written Compliance Plan

3. ____ Written Respiratory Protection Program

4. ____ Current Worker Related Documentation

a.____ Copies of Recent BLL and ZPP Analysis Reports for Workers (Performed Within Previous 12 Months)

b.____ Medical Evaluation Stating Employee is Cleared for Respirator Use (Performed Within the Previous 6 Months)

c.____ Respiratory Fit Tests for Each Employee (Current by OSHA and Cal/OSHA Standards)

Note: Item 2 is outlined specifically on Pages 3 & 4, as Item 14 A - G. Items 3 and 4 are requirements of California Code of Regulations, Title 8. Item 1 above will also be required for all additional personnel assigned to the project but not submitted in the bid package documentation.

## LEAD-RELATED INTERIM CONSTRUCTION SUBMITTALS

1._____ Waste Stream Characterization Testing Results (prior to removal of waste from the site and generated during work impacting LBP). This does not include whole architectural components.

2._____ Exposure Assessment (Air Monitoring) Results of Employees Performing "Trigger Tasks" (Within 72 Hours of Sample Collection)

3._____ DOP Testing Documentation

4._____ Contractor's Daily Documentation Records Pertaining to Work Classified as "Trigger Tasks" (Within 10 Working Days of the end of a Day's Shift)

5._____ Worker Documentation for New Workers Assigned to the Project or Workers With Documentation on File Which Expired During the Project

## LEAD-RELATED POST CONSTRUCTION SUBMITTALS

Contractor shall provide the following post-construction submittals to the School District through the designated channels within thirty (30) days of completion of lead-related work.

1._____ Completed Uniform Hazardous Waste forms for lead waste disposal (if applicable with reference in the final letter that all waste forms have been submitted to the School District through proper channels).

2._____ Letter stating that all documentation has been submitted to the School District through proper channels, or stating the Contractor and their sub-contractors did not generate LBP waste during the performance of their work.

Note: Any item on this list submitted during the course of the project and received by the School District will not need to be submitted again, unless specifically requested.

Rev. 04/10/08

**END OF SECTION**

# SECTION 14 24 00 - HYDRAULIC ELEVATORS

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 hydraulic passenger elevators.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 05 12 00 "Structural Steel Framing" for the following:

   a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
   b. Structural-steel shapes for subsills that are part of steel frame.

3. Section 05 50 00 "Metal Fabrications" for the following:

   a. Attachment plates and angle brackets for supporting guide-rail brackets.
   b. Structural-steel shapes for subsills.
   c. Pit ladders.
   d. Cants in hoistways made from steel sheet.

4. Section 09 65 19 “Resilient Tile Flooring” for finish flooring in elevator cars.
5. Section 27 15 00 "Communications Horizontal Cabling" for telephone service for elevators.
6. Section 28 31 11 "Digital, Addressable Fire-Alarm System for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. List of completed school projects (three minimum) where submitted Elevators were installed under the 2013 California Building Code. Include DSA numbers, name of school districts, and name of Architects.

C. **DSA Deferred Approval Submittal**: Elevator Guide Rails and Support Brackets are a Division of the State Architect (DSA) Deferred Approval.

1. Design Elevator Guide Rails and Support Brackets, including comprehensive engineering analysis by a California registered Civil or Structural Engineer, using performance requirements and design criteria indicated.
2. Provide a minimum of 3 stamped and wet-signed copies of drawings, specifications, and structural calculations prepared and signed by a California Registered Civil or Structural Engineer to the Architect for review and submittal to DSA for review and approval. These are in addition to the number of shop drawings/submittal documents necessary for review by the Architect during the submittal review process.
3. The Architect and/or Structural Engineer in general responsible charge shall review the submittal and affix a statement of general conformance per DSA IR-18 before submitting to DSA for review and approval.
4. Fabrication and installation shall not begin until DSA approval.

D. Shop Drawings (included as part of the DSA Deferred Approval Submittal):

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
4. List the weight of the car and rate capacity load. Include the Design Load and required distribution of load. (2013 CBC, 1616 A1.27)
5. Provide structural framing supports for the guide rails. Limit the separator beam and support member deflection to ¼" (ASME A17.1).
6. Provide structural framing for machine and sheave beams, elevator machinery and equipment. Limit static load deflection of machine and sheave beams and intermediate supports to 1/1666 of span (2007 AMSE, Section 2.9.5 and 3.9)
7. Provide elevator door support framing and details.

E. Samples for Initial Selection: For finishes involving color selection.

F. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch- square Samples of sheet materials; and 4-inch lengths of running trim members.

G. Qualification Data: For Installer.

H. Seismic Qualification Certificates: For elevator equipment, 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. 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.

I. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

J. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.9 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide ThyssenKrupp Elevator; Endura 35A or comparable product by one of the following:

1. American Crescent Elevator Mfg., Corp.
2. Fujitec America, Inc.
3. KONE Inc.
4. Minnesota Elevator, Inc.
5. Mowrey Elevator Co.
6. Otis Elevator Co.
7. Schindler Elevator Corp.
8. Schumacher Elevator Co.
9. ThyssenKrupp Elevator.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with section 11B-407 of CCR Title 24, Part 2, California Building Code – Accessibility Standards as enforced by DSA.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and Chapter 16A of the California Building Code and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.20 (seismic risk Zones 3 and 4).
3. Provide earthquake equipment required by ASME A17.1/CSA B44.
4. Provide seismic switch required by ASCE/SEI 7.
5. Design earthquake spectral response acceleration short period (Sds) for Project is 0.665g.
6. Project's Seismic Design Category: D.
7. Elevator Component Importance Factor: 1.0.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Type: Holeless, beside-the-car, single-acting, dual cylinder.

2. Rated Load: 3500 lb.
3. Rated Speed: 110 fpm.
4. Operation System: Single automatic.
5. Security Features: Keyswitch operation.
6. Car Enclosures:

    a. Inside Clear Width: 6'-8" from side wall to side wall.
    b. Inside Clear Depth: 5'-5" from back wall to front wall (return panels).
    c. Clear Cab Height: 7'-4" with 5/16 inch floor recess to underside of ceiling.
    d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Side and Rear Wall Panels: Plastic laminate.
    g. Reveals: Satin stainless steel, No. 4 finish.
    h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    i. Door Sills: Aluminum, mill finish.
    j. Ceiling: Flat steel with 4 LED lights.
    k. Handrails: 1-1/2 inches round satin stainless steel, No. 4 finish, at sides and rear of car. Clearance between support rails shall and adjacent surfaces shall be 1 ½ inches. Top of support rails shall be 31 inches minimum to 33 inches maximum above the floor of the car. The ends of the support rails shall be 6 inches maximum from adjacent walls. Support rails shall be smooth and any surface adjacent to them shall be free of sharp or abrasive elements. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds is applied at any point on the support rail, fastener, mounting device, or supporting structure.
    l. Floor prepared to receive resilient flooring (specified in Section 09 65 00 "Resilient Flooring").

7. Hoistway Entrances:

    a. Width: 42 inches.
    b. Height: 84 inches.
    c. Type: Single-speed side sliding.
    d. Frames at First Floor: Satin stainless steel, No. 4 finish.
    e. Frames at Other Floors: Satin stainless steel, No. 4 finish.
    f. Doors at First Floor: Satin stainless steel, No. 4 finish.
    g. Doors at Other Floors: Satin stainless steel, No. 4 finish.
    h. Sills at First Floor: Aluminum, mill finish.
    i. Sills at Other Floors: Aluminum, mill finish.

8. Hall Fixtures at First Floor: Satin stainless steel, No. 4 finish.
9. Hall Fixtures at Other Floors: Satin stainless steel, No. 4 finish.
10. Additional Requirements:

    a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
    b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.4 SYSTEMS AND COMPONENTS

A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts or shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch- thick, glass-fiber insulation board.
2. Motor shall have solid-state starting.
3. Motor shall have variable-voltage, variable-frequency control.

B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.

C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

D. Hydraulic Fluid: Nontoxic, biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives and approved by elevator manufacturer for use with elevator equipment.

1. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.

E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

F. Car Frame and Platform: Welded or bolted steel units.

G. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

1. Door and signal timing: The minimum acceptable time from notification that a car is answering a call or notification of the car assigned at the means for the entry of destination information until the doors of that car start to close shall be calculated from the following equation: T=D/(1.5 ft/s) = 5 seconds minimum where T equals the total time in seconds and D equals the distance in feet from the point in the lobby or corridor 60 inches directly in front of the farthest call button controlling the car to the centerline of its hoistway door.
2. Door delay: Elevator doors shall remain fully open in response to a car call for 5 seconds minimum.

B. Security Features: Provide the following security features at each floor. Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Push-Buttons are activated and deactivated by security keyswitches at hall push-button stations. Key is removable only in deactivated position.
2. Height: Keyshwitch shall be located at 40 inches minimum to 48 inches maximum measured to the centerline of the highest operable part.
3. Clear floor or ground space: A 30 inch wide by 48 inch deep clear floor or ground space shall be provided at keyswitch.
4. Location: The keyswitch shall be located adjacent to the push-buttons.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams between the heights of 5 inches nominal and 29 inches nominal above finish floor shall cause doors to stop and reopen. Door reopening shall remain effective for 20 seconds minimum. The device shall not require physical contact to be activated, although contact is permitted to occur before the door reverses.

2.7 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: APA Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness. Subfloor shall be compatible with the installation of the Mondo Zeus Rubber Floor Tile.
2. Floor Finish: Specified in Section 09 65 19 “Resilient Tile Flooring”.
3. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to manufacturer's standard honeycomb core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color: Wilsonart Laminate #4872-60 “Western Storm.”
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
9. Metal Ceilings: Brushed Stainless Steel with 4 LED lights.
10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Enameled-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
2. Primed-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.
3. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.

B. Car-Control Stations: Provide manufacturer's standard car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Controls shall be located at 48 inches maximum above finished floor measured to the centerline of the highest operable part of the control panel.
2. Size and Shape: Buttons shall have square shoulders, be ¾ inch minimum in their smallest dimension and be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface.
3. Arrangement: Buttons shall be arranged with numbers in ascending order. When two or more columns of buttons are provided they shall read from left to right.
4. Illumination: Car control buttons shall be illuminated.
5. Operation: Car control buttons shall be activated by a mechanical motion that is detectable.
6. Mark buttons and switches for required use or function with tactile characters or symbols, white on black background, complying with 2013 CBC Section 11B-703.2 and Braille complying with 2013 CBC Section 11B-703.3. Raised characters or symbols and Braille designations shall be placed immediately to the left of the control button to which the designations apply.
7. Emergency control buttons, including the emergency alarm shall be grouped at the bottom of the panel with their centerlines 35 inches minimum above the finish floor.
8. Symbols: The control button for emergency stop, alarm, door open, door close, main entry floor, and phone shall be identified with raised symbols, and Braille as shown in 2013 CBC Table 11B-407.7.1.3.
9. Visible Indicators: Buttons with floor designations shall be provided with visible indicators to show that a call has been registered. The visible indication shall extinguish when the car arrives at the designated floor.
10. Button Spacing: A minimum clear space of 3/8 inch or other suitable means of separation shall be provided between rows of control buttons.
11. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use per ASME A17.1. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply. Raised symbols or characters, white on a black background, and Braille shall be provided adjacent to the device and shall comply with Sections 11B-703.2 and 11B-703.3.

D. Car Position Indicators:

1. Provide illuminated, digital-type car position indicator, located above car door or above car-control station.

   a. Characters shall be ½ inch high minimum.
   b. Corresponding floor character shall illuminate as the car passes a floor and when a car stops at a floor served by the elevator.

2. Provide automatic audible/verbal annuciator to indicate to passengers that car is either stopping at or passing each of the floors served.

   a. Signal Level: The audible/verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB measured at the annunciator.

   b. Frequency: The audible/verbal annunciator shall have a frequency of 300 Hz minimum to 3000 Hz maximum.

3. Include travel direction arrows if not provided in car-control station.

E. Hall Push-Button Stations (Call Controls): Provide one hall push-button station at each landing.

1. Provide manufacturer's standard wall-mounted units.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.
3. Height: Push-Buttons shall be located at 40 inches minimum to 48 inches maximum measured to the centerline of the highest operable part.
4. Size and shape: Push-Buttons shall have square shoulders, be ¾ inch minimum in the smallest dimension and shall be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface. The buttons shall be activated by a mechanical motion that is detectable.
5. Clear floor or ground space: A 30 inch wide by 48 inch deep clear floor or ground space shall be provided at call controls.
6. Location: The push-button that designates the up direction shall be located above the call button that designates the down direction.
7. Signals: Push-Buttons shall have visible signals that will activate when each call is registered and will extinguish when each call is answered. Push-Buttons shall be internally illuminated with a white light over the entire surface of the button.

F. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:

1. Units mounted in both jambs of entrance frame, visible from the floor area adjacent to the hall call buttons.
2. Visible signal fixtures shall be centered at 72 inches minimum above finish floor.
3. The visible signal elements shall be a minimum of 2 ½ inches high by 2 ½ inches wide.

G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down. Audible signals shall have a frequency of 1500 Hz maximum. The audible signal shall be 10 dB above ambient, but shall not exceed 80 dB, measured at the hall call button.

1. At manufacturer's option, audible signals may be placed on cars.

H. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

I. Floor Designation Hoistway Signs: Floor designations complying with 2013 CBC sections 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of elevator hoistway entrances. Floor designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches high. A raised star, placed to the left of the floor designation, shall be provided on both jambs at the main entry level. The outside diameter of the star shall be 2 inches and all points shall be of equal length. Raised characters, including the star shall be white on a black background. Braille complying with 2013 CBC section 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be “MAIN”. Applied plates are acceptable if they are permanently fixed to the jamb.

2.10 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Stainless-Steel Bars: ASTM A 276, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

G. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 INSTALLATION

A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Install piping above the floor, where possible. Install underground piping in casing.

E. Lubricate operating parts of systems as recommended by manufacturers.

F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.

H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

I. Illumination: The level of illumination at the car controls, platform, car threshold and car landing sill shall be 5 foot candles (54 lux) minimum.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.

6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s). Training shall be video recorded and provided to owner on a playable DVD.

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.

**END OF SECTION 14 24 00**

# SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

C. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.

G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2012.

H. ASME B16.11 - Forged Fittings, Socket-welding and Threaded; 2011.

I. ASME B16.25 - Buttwelding Ends; 2012.

J. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2004.

K. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

M. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).

N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

O. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

P. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2013.

Q. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2013.

R. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

T. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

U. AWWA C606 - Grooved and Shouldered Joints; 2011.

V. FM (AG) - FM Approval Guide; current edition.

W. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

X. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

Y. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

Z. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Se Sectio 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified this section.

1. Minimum three years experience.

C. Conform to UL (DIR) requirements.

D. Valves: Bear FM (AG) and UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform to NFPA 13.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.2 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.25, buttweld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
2. Joints: Welded in accordance with AWS D1.1/D1.1M.
3. Casing: Closed glass cell insulation.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded.

a. Schedule 10 Pipe: Shall be U.L. approved with U.L. approved grooved fittings and couplings for pipe sizes 2-1/2" and larger only. Schedule 10 pipe shall not be used for pipe sizes less than 2-1/2". Threaded fittings shall not be used for any Schedule 10 pipe.

2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical formed fittings, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.

2.4 PIPE SLEEVES

A. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

E. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.5 ESCUTCHEONS

A. Material:
1. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:
1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.6 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.7 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron conforming to ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.

2.8 GATE VALVES

A. Up to and including 2 inches:
1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.

2.9 GLOBE OR ANGLE VALVES

A. Up to and including 2 inches:
1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:
1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.10 BALL VALVES

A. Up to and including 2 inches:
1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

2.11 BUTTERFLY VALVES

A. Cast or Ductile Iron Body
1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.12 CHECK VALVES

A. Up to and including 2 inches:
1. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches:
1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

2.13 DRAIN VALVES

A. Ball Valve:
1. Brass with cap and chain, 3/4 inch hose thread.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Sleeve pipes passing through partitions, walls, and floors.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

H. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Provide copper plated hangers and supports for copper piping.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with elastomeic caulk or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber conforming to ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with elastomeric caulk or mechanically expandable chloroprene inserts with mastic-sealed components.

M. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

N. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

O. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

P. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

Q. Provide gate valves for shut-off or isolating service.

R. Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

# SECTION 21 05 53 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. Section 09 91 23 - Interior Painting: Stencil paint.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Pipe markers.

F. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: Equipment, control panels 1 inch.
   3. Letter Height: Controls and small components, 1/4 inch.
   4. Background Color: Black.

2.4 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.5 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

B. Paint for Stencils: As specified in Section 09 91 23, semi-gloss enamel, colors conforming to ASME A13.1.

2.6 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completly around pipe and overlapped.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.7 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 91 23.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify valves in main and branch piping with tags.

H. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

# SECTION 21 13 00 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

C. Fire department connections.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

D. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

C. NFPA 1963 - Standard for Fire Hose Connections; 2014.

D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

E. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
   1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components and accessories. Indicate system controls.
   3. Submit shop drawings to DSAFire Marshall for approval. Submit proof of approval to Architect.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
   3. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL and FM requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in California.
   1. Contractor shall provide a complete and operable system including all electrical wiring and components. Wiring shall be installed in conduit in accordance with Division 16.
   2. Fire sprinkler systems shall be designed and installed in accordance with NFPA 13 with California Amendments. The sprinkler systems shall be hydraulically calculated in accordance with NFPA 13.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum _____ years experience documented experience.

F. Equipment and Components: Provide products that bear UL and FM label or marking.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.

B. Contractor shall design seismic bracing for all fire protection equipment and systems to comply with the 2016 California Building Code (CBC), the latest edition of the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
   1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
   2. Drawings, details and calculations shall be submitted to the Architect for review. Compliance documents shall be approved by the Architect prior to installation.

C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits and other components.

D. Supports, anchorage and restraints, including attachments to building structure, for all piping for standard installation details that comply with the latest edition of the Mason Industries "Seismic Restraint Guidelines", or equal, shall be used wherever possible. The Contractor shall provide all supporting documentation required for the Architect and the reviewing authorities. If compliance with one of these standards is demonstrated, separate structural calculations are not required.

E. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the State of California.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted on Drawings, including all areas, rooms, spaces below ceilings, entry ways, overhangs (if applicable), etc. and all other areas requiring sprinklers in accordance with NFPA 13.

B. Occupancy: Light hazard; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.2 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching screw on escutcheon plate.
   1. Finish: Enamel, color white.
   2. Escutcheon Plate Finish: Enamel, color white.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Standard upright type with guard.
   1. Finish: Brass.
   2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Sidewall Type: Standard horizontal sidewall type with matching screw on escutcheon plate .
   1. Finish: Enamel, color white.
   2. Escutcheon Plate Finish: Enamel, color white.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Guards: Finish to match sprinkler finish.

2.3 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
   1. Activate electric alarm.
   2. Test and drain valve.
   3. Replaceable internal components without removing valve from installed position.

B. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.

C. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

D. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

E. Fire Department Connections:
   1. Type: Exposed, projected wall mount made of corrosion resistant metal complying with UL 405.
      a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
      b. Outlet: Back with pipe threads, 4 NPS.
      c. Rated Working Pressure: 175 psi.
      d. Finish: Chrome.
      e. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

D. Locate outside alarm gong on building wall as indicated on Fire Sprinkler Shop Drawings.

E. Place pipe runs to minimize obstruction to other work.

F. Place piping in concealed spaces above finished ceilings.

G. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

H. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

I. Flush entire piping system of foreign matter.

J. Install guards on sprinklers where indicated.

K. Hydrostatically test entire system.

L. Require test be witnessed by DSA Fire Marshal.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION **21 13 00** - **FIRE SUPPRESSION SPRINKLERS**

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

C. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.

D. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013 with 2013 California Amendments.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components and accessories. Indicate system controls.
3. Submit shop drawings to DSA Fire Marshall for approval. Submit proof of approval to Architect.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL and FM requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Eureka, California.

1. Contractor shall provide a complete and operable system including all electrical wiring and components. Wiring shall be installed in conduit in accordance with Division 16.
2. Fire sprinkler systems shall be designed and installed in accordance with NFPA 13 with California Amendments. The sprinkler systems shall be hydraulically calculated in accordance with NFPA 13.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section documented experience.

F. Equipment and Components: Provide products that bear UL and FM label or marking.

G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.

B. Contractor shall design seismic bracing for all fire protection equipment and systems to comply with the 2013 California Building Code (CBC), the latest edition of the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
2. Drawings, details and calculations shall be submitted to the Architect for review. Compliance documents shall be approved by the Architect prior to installation.

C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits and other components.

D. Supports, anchorage and restraints, including attachments to building structure, for all piping for standard installation details that comply with the latest edition of the Mason Industries "Seismic Restraint Guidelines", or equal, shall be used wherever possible. The Contractor shall provide all supporting documentation required for the Architect and the reviewing authorities. If compliance with one of these standards is demonstrated, separate structural calculations are not required.

E. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the State of California.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted on Drawings, including all areas, rooms, spaces below ceilings, entry ways, overhangs (if applicable), etc. and all other areas requiring sprinklers in accordance with NFPA 13.

B. Occupancy: Light hazard; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.2 SPRINKLERS

2.3 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching screw on escutcheon plate.
   1. Finish: Enamel, color white.
   2. Escutcheon Plate Finish: Enamel, color white.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Standard upright type with guard.
   1. Finish: Brass.
   2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Sidewall Type: Standard horizontal sidewall type with matching screw on escutcheon plate.
   1. Finish: Enamel, color white.
   2. Escutcheon Plate Finish: Enamel, color white.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Guards: Finish to match sprinkler finish.

2.4 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
   1. Activate electric alarm.
   2. Test and drain valve.
   3. Replaceable internal components without removing valve from installed position.

B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate outside alarm gong on building wall as indicated on Fire Sprinkler Shop Drawings.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

H. Flush entire piping system of foreign matter.

I. Install guards on sprinklers where indicated.

J. Hydrostatically test entire system.

K. Require test be witnessed by DSA Fire Marshal.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

# SECTION 22 05 10 - PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References.

B. Description of Work.

C. Drawings and Specifications.

D. Industry Standards and Codes.

E. Site Examination.

F. Permits, Fees and Utility Connections.

G. Coordination of Work.

H. Progress of Work.

I. Submittals

J. Operation and Maintenance Manuals.

K. Project Record Documents.

L. Warranty.

M. Quality and Care

N. Access Doors.

1.2 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the plumbing systems.

C. The requirements of this Section apply to all Work of Division 22.

D. Section 01 33 00 - Submittals.

E. Section 01 40 00 - Quality Requirements.

F. Section 01 77 00 - Closeout, for closeout submittals.

1.3 REFERENCES

A. ANSI - American National Standards Institute.

B. ASTM - American Society for Testing Materials.

C. CEC - California Electric Code.

D. NEMA - National Electric Manufacturers' Association.

E. NFPA - National Fire Protection Association.

F. OSHA - Occupational Safety and Health Act.

G. UL - Underwriters' Laboratories.

H. See detailed References that are listed in individual sections.

1.4 DESCRIPTION OF WORK

A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Plumbing System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.

B. The work shall also include the completion of details of plumbing work not mentioned or shown which are necessary for the successful operation of plumbing systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.5 DRAWINGS AND SPECIFICATIONS

A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, and other plumbing work. Use judgement and care to install plumbing work to fit the job conditions within the building construction and finishes, and to function properly.

B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing plumbing systems locations with respect to other architectural, structural, mechanical and electrical work, existing and new. Do not scale distances off of the plumbing drawings. Use actual building dimensions.

C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.

D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.6 INDUSTRY STANDARDS AND CODES

A. The Plumbing Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.

B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
   1. California Building Code, 2016.
   2. California Mechanical Code, 2016.
   3. California Plumbing Code, 2016.
   4. California Electrical Code, 2016.
   5. National Fire Protection Association.
   6. California Fire Code, 2016.
   7. California State Fire Marshal.
   8. Occupational Safety and Health Administration, including CAL-OSHA.
   9. State of California Energy Conservation Standards.
   10. State of California Code of Regulations, Title 24.
   11. Other applicable state laws.

C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

D. No material or product installed as a part of the Work shall contain asbestos in any form.

1.7 SITE EXAMINATION

A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.8 PERMITS, FEES AND UTILITY SERVICES

A. Contractor shall pay for and obtain all permits and service required in the installation of this work.

B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.9 COORDINATION OF WORK

A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the plumbing work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.

B. The Contractor shall give careful consideration to the work of the General, Mechanical, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.

C. Arrange plumbing work in a neat, well-organized manner with the piping and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire plumbing work with adequate access for operation and maintenance.

D. Verify the location of all equipment, air distribution devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

1.10 PROGRESS OF WORK

A. This Contractor shall organize his work so that the progress of the plumbing work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Plumbing systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.

B. Contractor shall design seismic bracing for all plumbing equipment and systems to comply with the 2016 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".

1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
2. Drawings, details and calculations shall be submitted to the Engineer for review. Compliance documents shall be approved by the Engineer prior to installation.

C. Plumbing systems and equipment shall include, but are not limited to, all ductwork, piping, air conditioning equipment, heating and ventilating equipment, air handlers, fans, electrical and control panels, conduits and other components.

D. Supports, anchorage and restraints for all piping and ductwork for standard installation details that comply with the latest edition of the latest edition of the Mason Industries "Seismic Restraint Guidelines", or equal, shall be used wherever possible. The Contractor shall provide all supporting documentation required for the Engineer and the reviewing authorities. If compliance with one of these standards is demonstrated, separate structural calculations are not required.

E. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.12 SUBMITTALS

A. See Section 01 33 00 - Submittals, for additional submittal procedures.

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Notice to Proceed.
   2. For products specified only by reference standards, list applicable reference standards.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project.

E. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.

F. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

G. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

H. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.

I. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

1.13 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Architect will consider requests for substitutions only within 7 days after date of Agreement.

C. Substitutions will not be considered when a product becomes unavailable through no fault of the Contractor.

D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.

E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

F. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Owner and Architect for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.

I. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Architect will notify Contractor in writing of decision to accept or reject request.
   4. Present each substitution individually. If a proposed substitute in not found to be acceptable, then the specified item shall be supplied.

1.14 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 77 00 Closeout for Operation and Maintenance Manual requirements.

B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all plumbing systems and each piece of equipment furnished under these specifications.

C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
   1. Plumbing Systems.
   2. Piping Systems.
   3. Motors.
   4. Water Balance and Test Reports.

D. Provide manufacturer's model number, design data, capacities, etc. for each piece of plumbing equipment furnished as a part of the Work.

E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.

F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.

G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.

H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.15 PROJECT RECORD DOCUMENTS

A. See Section 01 77 00 - Closeout for Project Record Document requirements.

B. Record (As built) Drawings:
   1. Supplementing the requirements of the General Conditions and Supplementary General Conditions, As-Built Drawings shall show invert elevations of sanitary sewers, rain water leaders and storm sewers of critical locations, locations of shut-off valves and stub-outs for future, and all changes made during the course of the work. Furnish reproducible drawings when work is complete.
   2. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein
   3. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect.

1.16 QUALITY ASSURANCE

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

1.17 WARRANTY

A. See Section 01 77 00 - Contract Closeout, Warranties, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 QUALITY AND CARE

A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).

B. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.

C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.

D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.

E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

F. Inspect and report concealed damage to carrier within their required time period.

G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.

H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.2 ACCESS DOORS

A. Coordinate access door requirements with Section 08 31 13. The more stringent requirements shall govern.

B. Provide access doors where access through floors, walls or ceilings is required to access plumbing, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.

1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.

2. Ceiling access panels to be minimum 24x24 (or required and approved size).
3. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.

C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Karp, Elmdor, In-Ryko, Acudor, or approvedequal. Comply with the following:
1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
2. Concealed hinges to allow 175 degree opening.
3. Locks: flush, screw driver operated cam lock(s). Provide two keys for each set of locks provided.
4. Provide anchoring devices suitable for the construction into which the doors are framed.

D. Application (as applicable):
1. In gypsum drywall walls and ceilings: Type DW.
2. In ceramic tile walls: Type MS (stainless steel).
3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

PART 3 EXECUTION

3.1 INSTALLATION

A. Access Doors
1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

3.2 OWNER-FURNISHED EQUIPMENT

A. Some equipment is to be furnished under another Contract and is indicated as such on Drawings. Rough-in for such equipment, receive, uncrate, install and connect plumbing equipment, faucets, and fixtures as furnished by others. Furnish and install stops, traps, strainers, backflow preventers, valves and other appurtenances not furnished by others in order to provide a complete operating system.

B. Comply with paragraph on Plumbing Fixtures Installation, this Section, for installation procedures.

C. Refer to plumbing fixture connection schedule on Drawings.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with the requirements within this section.

B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.4 TESTING AND INSPECTION

A. See individual specification sections for additional testing and inspection required.

B. Testing Agency Duties:
1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.

4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.5 GENERAL TESTING REQUIREMENTS FOR PLUMBING SYSTEMS

A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all plumbing and gas piping testing.
1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.

B. Testing:
1. General:
   a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
   b. Notify Architect and local Plumbing Inspector two days before tests.

c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to a water pressure of a minimum of 5 PSI head. System to hold water without a water level drop greater than 1/2 pipe diameter of largest nominal pipe size within a 24-hour period. Test system in sections if minimum head cannot be maintained in each section. The 5 PSI head to be the minimum pressure at the highest joint.

d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for a period of two hours with no loss in pressure.

e. Send test results to Architect for review and approval.

2. Testing of Pressurized Systems:

a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

c. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at a hydrostatic pressure of 125 PSIG.

3. Gas Piping:

a. Cap openings and test with compressed air or nitrogen. Systems to maintain test pressure for a period of 24 hours with no leaks or pressure loss.

b. Test Pressure: 100 PSIG. Use only nontoxic soap and water or commercially approved leak detector liquids for leak detection. Testing mediums and apparatus required to be oil free.

c. Energize and test equipment connected to piping for proper operation. Test "final" gas piping and fittings installed on equipment beyond the rough in piping for leakage using an electronic ionization gas detector. Submit a certificate indicating the completion of the prescribed testing procedure and that such equipment and piping is free from leakage. Test pressures not to exceed recommendations or instructions by manufacturers of equipment and devices.

4. Repair:

a. Repair piping system sections which fail the required piping test by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

b. Drain or purge test water, air, or nitrogen from piping system after testing and repair work have been completed.

3.6 CUTTING AND PATCHING

A. Submit written request in advance of cutting or alteration which affects:

1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.

B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of plumbing and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new Products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.

I. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.7 PRIMING AND PAINTING

A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted including black steel piping located outdoors.
   1. Primer shall be as recommended by the paint manufacturer for each specific application.
   2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 09 90 00 for other acceptable products.

B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except piping, or factory primed or finished.

C. Preparation:
   1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
   2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
   3. Remove or protect hardware, electrical plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings which are adjacent to surfaces to receive coatings.
   4. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
   5. Galvanized Surfaces:
      a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
      b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
   6. Uncoated Steel And Iron Surfaces:
      a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
      b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
   7. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:
   1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.

2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Finish Painting: See Section 09 90 00.

END OF SECTION

# SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 23 23 00 - Refrigerant Piping.

1.3 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015.

B. EJMA (STDS) - EJMA Standards; Tenth Edition.

C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

E. Maintenance Data: Include adjustment instructions.

1.5 REGULATORY REQUIREMENTS

A. Conform to UL (DIR) requirements.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com.

B. Inner Hose: Carbon steel.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

2.3 SEISMIC PIPE LOOPS

A. General: Seismic connectors for straight pipe runs to be designed with sufficient live length on each flexible leg to provide the minimum movement in directions as required by movement allowed at joint. Verify with structural total movement required in planes and list with submittal.

B. Materials: Type 321 stainless steel hose and braid, with carbon steel elbows and ends. Flanged connectors will be used in steel piping 2-1/2 inches or larger, and threaded connectors for piping smaller than 2-1/2 inches. Carbon steel FNPT drain port will be utilized on connectors. For copper piping systems, manufacture connectors with bronze hose and braid and copper elbows and sweat ends. Guide seismic connectors per manufacturer's guidelines.

C. Pressure Rating: 150 PSI.

D. Manufacturers: Unisource, Metraflex, or approved.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

# SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

B. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Heat Transfer Equipment (Water Heaters): Nameplates.

B. Piping: Pipe markers.

C. Pumps: Nameplates.

D. Small-sized Equipment: Tags.

E. Tanks: Nameplates.

F. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 MANUFACTURERS

A. Brady Corp.

B. Seton Identification Products.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: Equipment, control panels 1 inch.
   3. Letter Height: Thermostats and small control components, 1/4 inch.
   4. Background Color: Black.

2.4 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Chart: Typewritten letter size list in anodized aluminum frame.

2.5 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. Access Doors and Similar Operational Instructions: Minimum 3/4" high letters.

B. Stencil Paint: As specified in Section 09900, semi-gloss enamel, colors conforming to ASME A13.1.

2.6 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completly around pipe and overlapped.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.7 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. Plumbing Valves: Green.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify domestic hot water heating equipment, including water heaters, pumps, expansion tanks, etc. with plastic nameplates.

F. Identify valves in main and branch piping with tags.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
   1. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.
   2. The legend and flow arrow shall be applied at all valve locations, at all points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction, and at approximately 20-foot intervals on pipe runs.
   3. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect to meet specific conditions.

4. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.
5. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.
6. The legends and flow arrows shall be in the colors as indicated in the pipe-marking schedule.
7. The paint shall be prepared enamel brushed on or sprayed from pressurized cans.
8. Where the pipe marking colors are not easily visible over the background, such as brown on soil pipe, orange on copper pipe, or similar combinations, a neat white or aluminum-colored background shall be painted on the pipe before the markings are applied.
9. The sizes, in inches, of the stenciled lettering and flow arrows shall be as follows:
    a. 5/8" to 2": 1/2" stencil letter; 2-1/2" flow arrow.
    b. 2-1/2" to 4": 1" stencil letter; 4" flow arrow.
    c. 5" to 7": 2" stencil letter; 5" flow arrow.
    d. 8" and larger: 3" stncil letter; 6" flow arrow.
10. Pipe Marking Legend: Gas - Yellow.

END OF SECTION

# SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 07 84 13 - Firestopping.

C. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

G. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY **REQUIREMENTS**

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER

A. Manufacturers:
1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.
1. Compatible with insulation.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
1. Armacell LLC; Armaflex: www.armacell.us.
2. Owens Corning Flex Tubing

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible and sheet for equipment and other surfaces.
1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.
2. Minimum Service Temperature: Minus 40 degrees F.
3. Maximum Service Temperature: 220 degrees F.
4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.
5. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
1. Manufacturers:
a. Armstrong Model 520.
b. Owens Corning Model 500.
c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Insulation Exposed to the Weather: Cover with aluminum jacket..

2.4 JACKETS

A. PVC Plastic.
1. Manufacturers:

a. Proto Corporation, Proto-Wrap 30 LoSmoke.
b. Johns Manville Corporation; _____: www.jm.com.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
   d. Thickness: 10 mil.
   e. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic: Compatible with insulation.
   a. Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

E. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, use a UL rated fire penetration assembly, 3M or equal.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

3.3 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot and Tempered Water Supply:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 1-1/4 inch and larger.
            (a) Thickness: 1.5 inch.
         2) Pipe Size Range: 1 inch and smaller.
            (a) Thickness: 1 inch.
   2. Domestic Cold Water Located in Unheated Areas:
      a. Glass Fiber Insulation:
         1) Pipe size range: Up to and including 2-1/2": Insulation thickness 0.5".
      b. Cellular Foam Insulation:
         1) Pipe Size Range: 2-1/2 inch and smaller
         2) Thickness: 0.5 inch.
   3. Domestic Hot Water Recirculation (Return):
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch.

END OF SECTION

# SECTION 22 10 05 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Chemical resistant sewer.
   3. Drains.
   4. Domestic water.
   5. Storm water.
   6. Gas.
   7. Flanges, unions, and couplings.
   8. Pipe hangers and supports.
   9. Valves.
   10. Check.
   11. Relief valves.
   12. Strainers.

B. Piping system work includes but not limited to:
   1. Aboveground soil, waste and vent piping within buildings, including soil stacks, vent stacks, horizontal branches, traps, and connections to fixtures and drains.
   2. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, terminating at connection to sanitary sewers 5 feet outside foundation wall.
   3. Conductor piping from roof drains to storm building drain.
   4. Storm building drain piping from conductor piping and area drains terminating at connection to storm sewers 5 feet outside foundation wall.
   5. Domestic cold water piping.
   6. Domestic hot water piping.
   7. Domestic circulating hot water piping.
   8. Specialty piping systems.
   9. Natural Gas System: Including new service connection and piping/meter assembly by serving utility company and costs/fees involving rough-in and connection to meter connections to gas equipment.
   10. Condensate drain and water piping system for plumbing equipment.
   11. Flashing and counterflashing of roof and wall penetrations required by installation of work of this Section.
   12. Furnishing and installation of access doors required for work furnished by this Section.
   13. Furnishing and installing of sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 07 84 13 - Firestopping.

C. Section 08 31 13 - Access Doors and Panels.

D. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

E. Section 22 07 19 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2011.

F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

G. ASME B31.1 - Power Piping; 2014.

H. ASME B31.9 - Building Services Piping; 2014.

I. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2015.

J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

L. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

N. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

O. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

P. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

R. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.

S. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.

T. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

U. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2014.

V. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2014.

W. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

X. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

Y. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

Z. AWWA C651 - Disinfecting Water Mains; 2005.

AA. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

AB. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

AC. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

AD. MSS SP-67 - Butterfly Valves; 2011.

AE. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AF. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

AG. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

AH. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AI. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

AJ. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

AK. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with State of California, standards.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of California plumbing code.

B. All plumbing piping, valves, etc. shall comply with State of California SB 1953 to be certified as lead free.

C. Conform to applicable code for installation of backflow prevention devices.

D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310 with MG couplings.
   3. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies. Heavy duty, Husky SD4000, .015 inch thick 304 stainless steel shield, 4-band coupling.

2.3 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. Copper Tube: ASTM B 306, DWV or ASTM B 88 (ASTM B 88M), Type M (C), Drawn (H).
   1. Application: Condensate drains.
   2. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   3. Joints: ASTM B32, alloy Sn50 solder.

2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET **OF BUILDING**

A. Copper Pipe: ASTM B 42, hard drawn, Type K.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: AWS A5.8, BCuP silver braze. Approved Fillers: "Phos 0," "Silfos 5," "Aircosil 15," "Braze 450(DE)." Use appropriate flux per manufacturer's recommendations.

2.5 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: For sizes 2-1/2" and smaller, ASTM B 32, alloy Sn95 solder.
   3. Joints: For sizes 3" and larger, AWS A5.8, BCuP5 silver braze.
   4. Pressure Range 81 to 150 PSI and Temperatures 151F to 200F: 95/5 tin-antimony or silver-bearing solders, i.e., Allstate 430, Harris Stay Brite 5 or 8.

B. Provide full solder cup for all fittings.

C. Schedule 40 Screwed Brass: Capped or plugged outlets.

2.6 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies. Heavy duty, Husky SD4000, .015 inch thick 304 stainless steel shield, 4-band coupling.

2.7 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.8 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Schedule 40, A53 black steel pipe and threaded malleable fittings 2 1/2 inches and smaller. Welded pipe 3 inches and larger. Pipe below grade wrapped with double thickness Scotchwrap No. 51 applied over Scotchwrap pipe primer. Factory applied epoxy coating to equivalent thickness with field wrapped or epoxied joints approved. Provide tinker test to check for holidays. Provide cathodic protection to meet requirements of NACE Standard RP0169-2002.

B. Polyethylene Pipe: ASTM D2513, SDR 11.
   1. Fittings: ASTM D2683 or ASTM D2513 socket type.
   2. Joints: Fusion welded.
   3. Pipe below grade shall have an insulated copper tracer wire installed adjacent to underground nonmetallic gas piping. Tracer wire insulation: yellow. Tracer wire shall meet requirements of CPC 1211.19.

2.9 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ASME B31.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.10 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Pipe size 2-1/2" and smaller: Malleable iron threaded fittings.

2. Pipe size 3" and larger: Steel butt welded fittings.
3. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
4. Joints: Threaded or welded to ASME B31.1.
5. Black steel piping exposed outdoors shall be painted. Refer to Sections 23 05 10 and 09 90 00.

2.11 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2 Inches and Under:
1. Steel Pipe Union: 150 PSI malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe.
2. Copper Pipe Union: 200 PSI working pressure. Bronze body, solder or grooved ends. Pipes 2 inches and under use ground joint, pipes 2-1/2 inches and larger use flanged face or grooved ends.
3. Insulating Unions: 250 PSI working pressure. Pipe ends and material to match piping. Electric current below 1 percent of galvanic current. Gasket material as recommended by manufacturer. Epco or approved.

B. Flanges for Pipe Size Over 1 Inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.12 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Conform to MSS SP-58.
2. Steel hanger rods and clevis shall be cadmium or zinc plated.
3. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
4. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
1. Conform to MSS SP-58.
2. Steel hanger rods and clevis shall be cadmium or zinc plated.
3. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
4. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
7. Vertical Support: Steel riser clamp.

8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.13 GATE VALVES

A. Manufacturers:
1. Nibco, Inc: www.nibco.com.
2. Crane Co. Valve Division
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up To and Including 2 Inches:
1. Class 125, bronze, screw in bonnet, solid wedge. Rising Stem: Nibco 111. Nonrising Stem: Nibco 113.

C. 2-1/2 Inches and Larger:
1. Class 125, iron body, bolted bonnet, flanged ends, renewable seat and disc, bronze mounted. Straight Body: Nibco F 718 B. Angle Body: Nibco F 818 B.

2.14 VALVES - GENERAL

A. General:
1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6 inches and smaller, and 4 inches and smaller for plug valves. Provide gear operators for quarter-turn valves 8 inches and larger. Provide chain-operated sheaves and chains for overhead valves.
3. End Connections: Mate with pipe, tube and equipment connections. Where more than one type is indicated, selection is installer's option.

B. Service:
1. Domestic Hot and Cold Water Shutoff and Isolation Valves:
   a. Pipe Sizes 2-1/2 Inches and Smaller: Ball valve.
   b. Pipe Sizes 3 Inches and Larger: Gate valve or butterfly valve.
2. Drain Service; All Pipe Sizes: Drain valves.
3. Bypass Around Pressure-Reducing Valves: Globe valves.
4. Check Valves: Swing check.
5. Relief Valve: ASME code approved pressure and temperature relief valve. Run full size pipe to floor drain, or as noted otherwise. Cash-Acme, Watts, or approved.
6. Pressure Regulating Valves: Natural Gas/L.P.G.: Diaphragm and spring actuated type, with ventless or vented relief feature. Construction, pressure range and venting features suitable for intended service. Regulator to meet code and serving utility requirements. Pipe vented type to atmosphere in approved location. Maxitrol, Equimeter, or approved.

C. Manufacturers: Crane, Fairbanks, Anvil, Jenkins, Kennedy, Walworth, Red/White (commercial grade), Mueller, Legend, Conbraco, Nibco, DeZurik, Hays, Powell, Stockham, Hammond, Watts, Milwaukee, or approved. Note: See individual sections for specialty valves (balancing valves, pressure regulators, relief valves, earthquake valves, gas valves).

2.15 BALL VALVES

A. Manufacturers:
1. Nibco, Inc: www.nibco.com.
2. Crane Co., Valve Division
3. DeZurik Co.
4. Milwaukee Valve Company: www.milwaukeevalve.com.
5. Stockham Valves and Fittings, Inc.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, three piece body, stainless steel ball, full port, teflon seats and stuffing box ring, stainless steel blow-out proof stem, lever handle with balancing stops, threaded ends with union. Nibco T-595-Y. Soldered: Nibco S-595-Y

2.16 NATURAL GAS VALVES

A. 2 Inches and Smaller: Ball valves. UL listed, two-piece construction, threaded, bronze body, conventional port, 250 PSI WOG working pressure. Watts B-6000UL.

B. 2-1/2 Inches and Larger: 100 to 125 PSI rated bronze or iron body/bronze trimmed plug cock type, square head or tee/lever handle operation. CSA approved.

2.17 GAS PRESSURE REGULATING VALVES

A. Manufacturers:
   1. American Meter.
   2. Invensys (Equimeter).
   3. Maxitrol

B. Provide single stage, steel jacketed, corrosion resistant gas pressure regulating valves with atmospheric vent and elevation compensator sized for inlet and outlet pressures , specific gravity and volume indicated on the drawings. Construction, pressure range and venting features suitable for intended service. Regulator to meet code and serving utility requirements. Pipe vented type to atmosphere in approved location.

C. For sizes 2" and smaller: threaded ends.

D. For sizes 2-1/2" and larger: flanged ends.

E. Provide low pressure cutout and internal relief for each regulator.

2.18 SEISMIC GAS SHUTOFF VALVES

A. Manufacturers: Safetquake, Quakemaster or equal.

B. Valve is fabricated of aluminum, incorporates a stainless steel ball and bubble level, is vertically mounted, has a single step manual reset lever, operates at ambient temperature range of -40 deg F to +150 Deg F, minimum pressure .5 psi and maximum allowable pressure of 60 psi.

C. Valves actuates within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of anyone of the following: (1) 0.70g and period of 0.13 second, (2) 0.40g and period of 0.20 second, (3) 0.30g and period of 0.40 second, (4) 0.25g and period of 1.00 second.

D. Valves shall not actuate when subjected for 5 seconds to a horizontal sinusoidal oscillation having a peak acceleration of anyone of the following: (1) 0.40g and period of 0.130second, (2) 0.20g and period of 0.20 second, (3) 0.15g and period of 0.40 second, (4) 0.10g and period of 1.00 second.

E. Meets or exceeds California standard, ANSI (Z21 1995), California Office of State Architect (Label Numbers CA-OSA 19.49 and CA-OSA 27.02, IAPMO, UPC (file 3D94), AGA P-70-2A, U.L. Building and Safety RR 4996.

2.19 BUTTERFLY VALVES

A. Manufacturers:
   1. Grinnell Products, a Tyco Business; B302: www.grinnell.com.
   2. Hammond Valve: www.hammondvalve.com.
   3. Crane Co.: www.cranevalve.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.
   5. Stockham Valves and Fittings, Inc.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.20 SWING CHECK VALVES

A. Manufacturers:
   1. Nibco, Inc: www.nibco.com.

2. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up to 2 Inches:
1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends. Nibco 413.

C. Over 2 Inches:
1. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged ends. Nibco F918.

2.21 RELIEF VALVES

A. Temperature and Pressure Relief:
1. Manufacturers:
a. Watts Regulator Company: www.wattsregulator.com.
b. Cash-Acme
2. AGA Z21.22 certified, bronze body, manual lever operator, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled. Sized to meet BTUH requirements.

2.22 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Charles M. Bailey.
3. Metraflex.

B. Size 2-1/2 inch (64 mm) to 4 inch (100mm):
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

2.23 WATER VALVE BOXES

A. Rectangular concrete valve box with cast iron hinged locking access cover, (traffic rated), labeled "water." Provide size adequate for depth, maintenance accessibility for valve assembly, and the like. Provide extensions as required. Manufacturers: Brooks Products Model 36-HFL, or approved.

2.24 PREMANUFACTURED COUNTERFLASHINGS

A. Factory-fabricated counterflashing constructed from Schedule 40 galvanized steel or galvanized malleable iron pipe coupling with tapered threads and 3 lb. lead sheet lead formed and soldered to coupling to produce counterflashing minimum of 4-inch overlap over roof flashings. Provide for pipe sizes as required. Manufacturers: A&B Sheetmetal, 503-254-5581.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Conform with applicable codes and industry standards.

C. Install uninsulated piping so that unrestrained direct contact with the structure or other system installations is avoided. Where contact with or passage through building or structural features cannot be avoided; firmly anchor piping to, or isolated from, the structure to prevent noise transmission and occurrence of physical damage. Install piping to be insulated with adequate clearance around piping to allow for placement of full thickness insulating material.

D. Corrosion Control:
   1. Underground Steel Piping Corrosion Protection: Factory wrap uninsulated underground steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3 inches above grade. Provide tinker test to check for holidays. Provide cathodic protection to meet requirements of NACE Standard RP0169-2002.
   2. Install hot water heating vessels with a stainless steel fitting at tank and a dielectric fitting on both supply and discharge sides of hot water tanks.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom, conserve space, and not interfere with use of space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Installation/Coordination:
   1. Expansion and Flexibility: Install work with due regard for expansion, contraction, and building settlement to prevent damage to the piping, ductwork, equipment and the building and its contents. Provide piping offsets, loops, expansion joints, anchors or other means to control pipe movement, to minimize pipe forces and effects of building settlement.
   2. Install piping to prevent stresses and strains to piping and hangers and supports due to expansion or contraction and building settlement. Provide proper loops, guides, offsets, anchor points, or expansion joints. Verify with anticipated settlement or shrinkage of building. Verify construction phasing of project, type of building construction products and type for coordinating installation of piping systems. Include provisions for servicing and removal of equipment without dismantling piping.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Excavate in accordance with the paragraphs in this Section and Divisions 31 and 32 for work of this Section.

O. Backfill in accordance with the paragraphs in this Section and Divisions 31 and 32 for work of this Section.

P. Install underground valves in valve box, Christy or equal, sized to allow access for maintenance.

Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

R. Sleeve pipes passing through partitions, walls and floors.

S. Pipe Sleeves:
   1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
   2. Floor Sleeves (Except DWV Piping at Slab on Grade): Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1 inch above finished floor. Caulk pipes passing through floor with nonshrinking grout or approved caulking compound. Provide "Link-Seal" sleeve sealing system for slab on grade. Caulk/seal piping and ductwork passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements.

3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with nonshrinking caulking compound. Caulk/seal piping and ducts passing through fire-rated building assemblies with UL approved fire-rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
4. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.

T. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Provide copper plated hangers and supports for copper piping.
7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 PIPING SYSTEMS INSTALLATION

A. Piping:
1. General: Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous materials as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops. Coordinate installation of piping below with structural components and other system installations.
2. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
3. Install piping pitched to drain at minimum slope of 1/4 inch per foot (2 percent). Where this slope is impractical, slope at 1/4 inch per foot for pipes below 4-inch size, and 1/8 inch per foot (1 percent) for piping 4 inches and larger, with the approval of the local code authority.
4. Install water piping to ASME B31.9.
5. Condensate Drain Piping at HVAC Units: Trap condensate drain for HVAC units. Install condensate drain piping with p-trap and slope to drain at minimum of 1/8 inch per foot slope.
6. Seismic Restraint: Brace plumbing piping and plumbing equipment against lateral movement as detailed in document "Seismic Restraint Manual Guidelines for Plumbing Systems" as published by SMACNA.
7. Rough-in Piping: Provide temporary caps or plugs at piping shown on Drawings to be roughed-in for future connections by others.
8. Sanitary Waste and Storm Drain Piping: Slope at uniform grade of 1/4 inch per foot unless noted otherwise. Make changes in size with reducing and wye fittings. Run exposed piping parallel or perpendicular to building structure.

9. Sanitary Waste Piping from Back-to-Back Water Closets: Provide individual rough-in piping for each back-to-back water closet, no common sanitary cross, double fixture or double combination wye and 1/8 bend fittings allowed.
10. Vent Piping:
    a. General: Horizontal runs free of drops and sloped to drainage system.
    b. Do not locate waste vents in equipment wells; locate waste vents down wind from outside air intakes of HVAC equipment.
    c. Vents-Through-Roof (VTRs): Provide flashing with counterflashing at vent penetrations through roof, as detailed. Install vent piping penetrating roofed areas to maintain integrity of roof assembly. Wherever vents run up near or inside of exterior walls, offset pipe at underside of roof deck to obtain minimum 5-foot clearance between parapet and roof penetration. Provide code required clearances between vent-through-roof and HVAC equipment on roof. VTR counterflashings to have a manufactured rolled return bend with minimum 1-inch overlap; crimping by hand tools will not be allowed. On single ply vinyl or plastic type roofs, provide flashings as required by roof installer and manufacturer. On raised rib steel roofs, provide flashings as required by roof installer and manufacturer.

B. Cleanouts: Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100 feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Coordinate locations and types of cleanouts with Architect prior to installation.

C. Equipment Connections:
1. Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by code.
2. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.
3. Piping Runouts to Fixtures: Provide hot and cold piping runouts to fixtures of sizes indicated, but in no case smaller than required by code.
4. Equipment Connections: Connect hot and cold water piping system to equipment as indicated, and comply with equipment manufacturer's instructions. Provide shutoff valve and union for each connection; provide drain valve on drain connection.

D. Domestic Water Distribution Piping:
1. Water Service Piping: Provide sleeve in foundation wall for water service entry; make entry watertight. Provide shutoff valve at water service entry inside building; pressure gauge, test tee with valve.
2. Water Hammer Arrestors: Install in upright position, in locations and of sizes in accordance with PDI WH-201, and elsewhere as indicated.
3. Group piping installations and valves where possible to obtain maximum practical use of available space.
4. Arrange locations of valves, unions, drains and other components to provide for ease of cleaning, operation, repair or service. Size access panels and locate to provide both acceptable proximity and working space for such devices.
5. Provide valves and shock arrestors where required by code and where otherwise indicated in Specifications and on Drawings.
6. Provide protection plates for piping installed in wood stud walls and other building substructures as required by code.
7. Wherever piping is installed in exterior walls, route on warm side of insulation and as close to inside wall finish as possible, as detailed.
8. Provide low point drains and shutoff valves as required by local AHJ. Provide valve boxes, access panels, and the like, for complete installation.

E. Valves:
1. Install valves with stems upright or horizontal, not inverted.

2. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.
3. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
4. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.
5. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.
6. Balancing Valves: Install in each hot water recirculating loop, and elsewhere as indicated.

F. Pressure Regulating Valves: Provide inlet and outlet ball valves, and globe valve bypass. Provide pressure gauge on valve outlet.

G. Gas Piping:
1. General: Provide shutoff valves, pressure regulators and unions at connections to gas-fired equipment. Provide dirt legs at low points.
2. Install gas piping in accordance with NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 1999. Purge, clean and charge piping in accordance with NFPA 54.
3. Adjust gas pressure regulating valves at full load condition to deliver required gas pressure to equipment.
4. Provide support for utility meters in accordance with requirements of utility companies.
5. Piping Through Roof: Coordinate exact location with roof structure and roof mounted equipment. Provide 2-1/2 lb. lead flashing with manufactured counterflashing at roof penetration.
6. Paint piping exposed to weather with one coat of Rustoleum.
7. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

H. Gas Regulator Vent Piping: Paint piping exposed to weather with one coat of Rustoleum.

3.5 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL/FLOOR ASSEMBLIES

A. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

B. Manufacturers: Hilti, Proset, or approved.

3.6 EXCAVATION AND BACKFILL:

A. General: Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work damaged by Contractor's operations.

B. Water: Keep excavations free of standing water. Reexcavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.

C. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.

D. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat, and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.

E. Support Foundations:
1. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material

in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other sections of Specifications or drawings.

2. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
3. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
   a. Material Passing 3/4-Inch Square Opening:
      1) Class A: Min 27; Max 47.
      2) Class B: Min 0; Max 1.

F. Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

G. Backfilling:
   1. Following installation and successful completion of required tests, backfill piping in lifts.
      a. In "Pipe Zone," place backfill material and compact in lifts not to exceed 6 inches in depth to a height of 12 inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
      b. Place and compact backfill above "Pipe Zone" in layers not to exceed 12 inches in depth.
   2. Backfill Material:
      a. Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
      b. Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

H. Compaction of Trench Backfill:
   1. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
      a. Mechanical tamper,
      b. Vibratory compacter, or
      c. Other approved methods appropriate to conditions encountered.
   2. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

3.7 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Provide ball valves in natural gas systems for shut-off service.

3.8 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.10 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 11 inch wg.

3.11 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inches to 3 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
      d. Pipe Size: 4 inches to 6 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION

# SECTION 22 10 06 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Drains.

B. Roof and floor drains.

C. Cleanouts.

D. Hose bibbs.

E. Hydrants.

F. Water hammer arrestors.

G. Trap primers.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 22 10 05 - Plumbing Piping.

C. Section 22 40 00 - Plumbing Fixtures.

1.3 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).

B. ASME A112.21.2M - Roof Drains; The American Society of Mechanical Engineers 2001.

C. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.

D. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

E. NSF 372 - Drinking Water System Components - Lead Content; 2011.

F. PDI-WH 201 - Water Hammer Arresters; 2010.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, cleanouts, water hammer arrestors.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Manufacturers:

1. Josam Company: www.josam.com.

2. Jay R. Smith Manufacturing Company.
3. Zurn Industries, LLC: www.zurn.com.
4. Watts.
5. Mifab.
6. Approved equal.

B. Roof Drains:
1. Manufacturer: Zurn Model Z-125-92 combination roof drain and overflow drain or Zurn Model Z-125 for roof drain and for overflow drain.
2. Assembly: ASME A112.21.2M.
3. Body: Lacquered cast iron with sump.
4. Strainer: Removable polyethylene dome with vandal proof screws.
5. Overflow: Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.
6. Accessories: Coordinate with roofing type:
   a. Membrane flange and membrane clamp with integral gravel stop.
   b. Adjustable under deck clamp.
   c. Roof sump receiver.
   d. Waterproofing flange.
   e. Controlled flow weir.
   f. Leveling frame.
   g. Adjustable extension sleeve for roof insulation.

C. Downspout Nozzles:
1. Bronze round with straight bottom section. Zurn Z-199, J.R. Smith, Mifab, or approved equal.

D. Floor Drain (FD):
1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer. Zurn, J.R. Smith, Wade, Watts, Mifab, or approved equal.

2.3 CLEANOUTS

A. General: Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4 inches will not be required. Plastic components not allowed, except unless specifically noted.

B. Types:
1. Tile Floor Cleanouts: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and vandalproof screws.
2. Carpeted Floor Cleanout: J. R. Smith 4020-U-X with carpet clamping frame with round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and vandalproof screws.
3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with vandalproof screws.
4. Concrete Floor Cleanout (Heavy Load): Same as for "General" locations, Item 3 above, except J. R. Smith 4100.
5. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.
6. Cleanouts in concealed aboveground cast iron soil or waste lines: Zurn Z-1440A with raised head ABS plastic plug.
7. Outside Area Walks and Drives: J. R. Smith 4023-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

C. Manufacturers: J. R. Smith, Zurn, Wade, Watts, or approved. J. R. Smith model numbers used as a basis of selection.

2.4 HOSE BIBBS

A. Manufacturers:
   1. Interior: Acorn Model 8121CR-LF; Exterior (roof): Acorn Model 8126-LF.
   2. Jay R. Smith Manufacturing Company.
   3. Watts Regulator Company: www.wattsregulator.com.
   4. Zurn Industries, LLC: www.zurn.com.
   5. Woodford.
   6. Mifab.

B. Interior Hose Bibbs:
   1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, rough chrome plated where exposed with lockshield and removable key, integral vacuum breaker in conformance with ASSE 1011.

C. Exterior Hose Bibbs:
   1. Bronze or brass, replaceable hexagonal disc, hose thread spout with wall plate, bronze nickel plated finish with lockshield and removable key, integral vacuum breaker in conformance with ASSE 1011.

2.5 HYDRANTS

A. Manufacturers:
   1. Acorn Model 8151 (cold water only).
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Zurn Industries, LLC: www.zurn.com.
   4. Woodford.
   5. Chicago.
   6. Mifab.
   7. Approved equal.

B. Wall Hydrants:
   1. ASSE 1019; valve shall be cartidge operated type with stainless steel lockable recessed box with wall flange, hose thread spout, lockshield and removable key, and integral vacuum breaker.

2.6 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   2. Zurn Industries, LLC: www.zurn.com.
   3. Amtrol.
   4. Wade.
   5. Approved equal.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F, maximum 125 psi working pressure and maximum 250 psi static pressure.

2.7 TRAP PRIMERS

A. Provide trap primers, 1/2 inch size, where indicated on drawings. Provide with built-in air gap and install 1/2" shutoff valve. PVC housings are not acceptable. Code approval required. Install trap primer line with 1/4" per foot slope to insure full drainage to floor drain or floor sink. Install tap primer behind wall with J.R. Smith 4740 access door. Manufacturer: Zurn, J.R. Smith, Wade, PPP, or approved equal.

B. Provide a distribution unit with feeder piping for a maximum of four (4) traps where multiple traps are serviced by a single trap primer.

2.8 THERMOMETERS

A. 3-inch diameter bi-metal dial thermometer with stainless steel case, white dial, black numbers with 4-inch stainless steel stem and brass separable socket. Provide back or bottom connections as required. 0F to 200F range. Manufacturers: Weiss Model 3BMS, Palmer, Ashcroft, Trerice, Marshaltown, Weksler, or approved.

2.9 PRESSURE GAUGES

A. Single-pointer gauge with 0 to 100 PSI range, 10 PSI intervals and 1 PSI increments intermediate graduations. Aluminum dial with 1 percent accuracy and low bottom connections for wall mounting. Manufacturers: Weiss, Palmer, Marshaltown, Trerice, Ashcroft, Weksler, U.S. Gauge, or approved.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install cleanouts in all horizontal soil and waste piping at 50 feet maximum spacing inside building, 100 feet maximum spacing outside building, at every change of direction and where shown on Drawings.

E. Install cleanouts in waste drops from each lavatory and sink.

F. Install cleanouts in rain water (storm drain) drops 18 inches above finished floor. For concealed rainwater drops extend cleanout to building exterior for access.

G. Install floor cleanouts at elevation to accommodate finished floor.

H. FLOOR DRAINS AND FLOOR SINKS
   1. General: Install drains in accordance with manufacturer's written instructions and in locations indicated.
   2. Coordinate with piping as necessary to interface drains with drainage piping systems.
   3. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of floor drains flush with finished floor. Set floor sinks as required by local codes.
   4. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   5. Position drains so that they are accessible and easy to maintain.
   6. Coordinate drain flashing, flanges and strainer types and depths with floor substrate and topping configuration.
   7. Primers: Prime drains. Refer to Drawings and coordinate location with Architect. Coordinate with local AHJ for exact requirements.

I. ROOF DRAINS/OVERFLOW DRAINS
   1. General: Install drains in accordance with manufacturer's written instructions and in locations indicated.
   2. Coordinate metal flashing work with work of roofing, waterproofing, and adjoining substrate work.
   3. Coordinate with roofing as necessary to interface roof drains with roofing work.
   4. Coordinate with storm water piping as necessary to interface drains with drainage piping systems.
   5. Install drains at low points of surface areas to be drained.
   6. Install drains flashing collar or flange so that no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   7. Position drains so that they are accessible and easy to maintain.
   8. Set overflow drains at proper elevation relative to main roof drains.

J. HOSE BIBBS (INSIDE)
   1. Install on exposed piping where indicated, with vacuum breaker.

K. HOSE BIBBS AND HYDRANTS
   1. Install where indicated, with vacuum breaker and in accordance with manufacturer's installation instructions.

L. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to drinking fountains, lavatories, sinks, urinals, and water closets.

M. Water Hammer Arrestors (Shock Absorbers): Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI WH201. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.

END OF SECTION

# SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Heaters:
   1. Commercial electric.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

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

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Water Heaters:
   1. Water heaters and storage tanks to meet current energy efficiency code requirements and be provided with anode rod corrosion protection, internal glass lining, insulated steel jacket with baked enamel finish, and pressure-temperature relief valve to match tank working pressure. Rate water heaters at 150 PSIG working pressure; rate storage tanks at 125 PSI working pressure. Refer to schedule on Drawings for capacity and model.
   2. ANSI Compliance: Comply with NFPA 58 "Liquefied Petroleum Gas Code," as applicable to installation of LP-fired appliances.
   3. CSA and NSF Labels: Provide water heaters which have been listed and labeled by CSA and NSF.
   4. ASME Code Symbol Stamps: For applicable equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME code symbol.
   5. ASME Relief Valve Stamps: Provide water heaters and water tanks with safety relief valves bearing ASME valve markings.
   6. Code Compliance: Comply with the UPC and ASHRAE 90.1-1999.
   7. PDI Compliance: Comply with applicable Plumbing and Drainage Institute Standards pertaining to factory fabricated water heaters.

1.6 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1 INSTANTANEOUS ELECTRIC WATER HEATERS

A. Provide instantaneous electric water heater by Chronomite, or approved equal, with capacity, power requirements, and features as specified on the drawings.

B. Heater shall have Celcon waterways and stainless steel heating coils, and shall be of the instantaneous type designed for point of use application without a storage vessel..

C. The heater shall include all controls and safeties. Unit shall have microprocessor temperature control, factory set, to provide constant supply temperature. Unit shall be the low flow type and shall activate upon sensing a flow of 0.4 GPM with a minimum pressure of 45 PSIG.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

END OF SECTION

# SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Service sinks.

F. Drinking fountains.

G. Fixtures:

1. Plumbing fixtures and trim, including rims for sinks and lavatories in casework or counters, chair carriers (as required), drinking fountains, drains, cleanouts, floor sinks, and related fixtures shown on the Drawings.
2. Rough and final connection to equipment and fixtures, relocated or provided under other sections by Owner and under other divisions of the work.
3. Standards and supports for equipment requiring them.
4. Instructions and maintenance manuals for equipment furnished by this Section.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.

C. Section 22 10 05 - Plumbing Piping.

D. Section 22 10 06 - Plumbing Piping Specialties.

1.3 REFERENCE STANDARDS

A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).

B. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

C. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

D. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

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

B. Manufacturers: Firms regularly engaged in manufacture of plumbing system products, of types, materials, and sizes required.

C. Regulatory Requirements:

1. Codes: Comply with UPC pertaining to plumbing materials, construction and installation of products. Comply with local and state regulations.

2. ANSI Compliance: Comply with applicable American National Institute standards pertaining to products and installation.
3. PDI Compliance: Comply with applicable Plumbing and Drainage Institute standards pertaining to products and installation.
4. Federal Standards: Comply with applicable Federal Specification WW-P-541 Series sections pertaining to plumbing fixtures.
5. NAHB Label: Provide fiberglass bathtub units and shower stalls which have been tested and labeled by NAHB Research Foundation.
6. ADA Compliance: Construct and install barrier-free plumbing fixtures in accordance with "The Americans with Disabilities" Act.
7. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by UL and which comply with NEMA standards.
8. CEC Compliance: Comply with CEC as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. See Section 01 78 36 - Warranties, for additional warranty requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 GENERAL REQUIREMENTS:

A. Refer to Architectural drawings for exact locations, fixture mounting heights and ADA accessibility requirements.

B. Insulate domestic hot water, tempered water and waste piping below handicapped plumbing fixtures with molded single piece removable insulation covers, foam, fire resistant, Truebro, or equal. Install insulation covers in accordance with ADA requirements.

C. Provide 85% IPS red brass pipe for each connection to faucets, stops, hose bibs, and other fixtures/trim. Securely anchor brass pipe to structure. Install stop valves on water supply lines for each fixture, except hose bibbs.

D. Provide compression shutoff control stop valves with IPS inlets and threaded brass nipples at pipe connection on water supplies to each fixture. Provide stops with lock shield loose key and key handle for each stop. For combination fixtures, provide with compression stop and IPS inlet on each water supply fitting.

E. Provide cast brass escutcheons, except escutcheons exposed to view shall have chrome plated finish.

F. Provide chromium-plated finish on fittings and accessories exposed to view.

G. Fixture fittings and trim: Conform to ASME A112.18.1M and ASME A112.19.5, as applicable.

H. Centerset faucets: Top-mounted with inlets on not greater than 4 inch centers, unless specified otherwise below.

I. Separate faucets and combination supply fittings: Provide inlets on 8 inch centers.

J. Zinc-alloy or plastic handles are not permitted for faucets and valves.

K. Provide special roughing-in for wheelchair fixtures.

L. Provide 0.5 GPM flow restrictor for all public lavatories.

M. Provide water hammer arrestors at end of pipe runs to two or more fixtures, properly sized with sufficient displacement volume to dissipate calculated energy in the piping systems. Water hammer arrestors shall be stainless steel shell with stainless steel bellows contained within the casing, Zurn Model Z-1700, or equal. See Section 22 10 06. Locate in accessible location or provide access panel with location approved by Architect.

N. Fixture dimensions specified are nominal.

2.3 PLUMBING FIXTURES

A. General: Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule on the Drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

1. Fixtures: Complete with fittings, supports, fastening devices, faucets, valves, traps, stops and appurtenances required.
2. Exposed IPS Piping and Tubing: Brass, chrome plated.
3. Escutcheons: Brass, chrome plated.
4. Fixture Locations: As shown on Drawings.
5. Stops: Stops installed in each supply pipe at each fixture accessibly located with wall escutcheons.
6. Public Lavatories: Provide with flow control device to prevent flow over 0.5 GPM.
7. Interior Faucets Except Public Lavatories: Provide with flow control device to prevent flow over 0.5 GPM.

2.4 FIXTURE TRIM

A. Traps: Provide traps on fixtures except fixtures with integral traps. Exposed traps chromium plated cast brass or 17 gauge chromium plated brass tubing. American Standard, Kohler, Chicago, BrassCraft, Eastman, Speedway, McGuire, or approved.

B. Supplies and Stops: First quality, chrome plated with brass stems. Stops: Loose key type. American Standard, Kohler, Chicago, BrassCraft, Eastman, Legend, Speedway, McGuire, or approved.

2.5 FLUSH VALVE WATER CLOSETS (WC-1)

A. Bowl:

1. Manufacturers:
   a. American Standard Inc; Model Afwall FloWise. 2856.128: www.americanstandard.com.
   b. Eljer: www.eljer.com.
   c. Kohler Company: www.kohlerco.com.
   d. Approved equal.
2. ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.
3. Mount at ADA accessible height.

B. Flush Valve Manufacturers:

1. Sloan Valve Company; Model Royal 111-1.28 : www.sloanvalve.com.

C. Exposed Flush Valve:

1. ASME A112.18.1M; exposed chrome plated, diaphragm type with ADA compliant oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.28 gallon flush.

2. ADA accessible.

D. Seat:
1. Manufacturers:
a. Bemis Manufacturing Company: www.bemismfg.com.
b. Church Seat Company: www.churchseats.com.
c. Olsonite; Model 10CC-SS: www.olsonite.com.
d. Beneke.
e. Approved equal.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

E. Water Closet Carrier:
1. Manufacturers:
a. J.R. Smith 100 or 200 Series.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.6 FLUSH VALVE WATER CLOSETS (WC-2)

A. Bowl:
1. Manufacturers:
a. American Standard Inc; Model Afwall FloWise. 2856.128: www.americanstandard.com.
b. Eljer: www.eljer.com.
c. Kohler Company: www.kohlerco.com.
d. Kohler Company: www.kohlerco.com.
2. ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

B. Flush Valve Manufacturers:
1. Sloan Valve Company; Model Royal 111-1.28 : www.sloanvalve.com.

C. Exposed Flush Valve:
1. ASME A112.18.1M; exposed chrome plated, diaphragm type with ADA compliant oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.28 gallon flush.
2. ADA accessible.

D. Seat:
1. Manufacturers:
a. Bemis Manufacturing Company: www.bemismfg.com.
b. Church Seat Company: www.churchseats.com.
c. Olsonite; Model 10CC-SS: www.olsonite.com.
d. Beneke.
e. Approved equal.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

E. Water Closet Carrier:
1. Manufacturers:
a. J.R. Smith 100 or 200 Series.
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.7 LAVATORIES (L-1)

A. Lavatory Manufacturers:
1. American Standard Inc; Model Lucerne No. 0355.012 "D" shaped bowl: www.americanstandard.com.
2. Eljer.

3. Kohler Company: www.kohler.com.
4. Approved equal.

B. Vitreous China Wall Hung Basin:
1. ASME A112.19.2; vitreous china wall hung lavatory 20 x 18 inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
   a. Drilling Centers: 4 inch.

C. Supply Faucet:
1. Trim: Chicago Model 3400-39VPABCP combination sink fitting, mixing faucet, 4" centers, push-on metering, 0.35 GPM flow restrictor, ASME A112.18.1M; chrome plated brass supply with standard spout.
2. ADA accessible.

D. Accessories:
1. Chrome plated 17 gage brass P-trap and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
   a. Manufacturers:
      1) J.R. Smith.
   b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.8 LAVATORIES (L-2)

A. Lavatory Manufacturers:
1. American Standard Inc; Model Lucerne No. 0355.012 "D" shaped bowl: www.americanstandard.com.
2. Eljer.
3. Kohler Company: www.kohler.com.
4. Approved equal.

B. Vitreous China Wall Hung Basin:
1. ASME A112.19.2; vitreous china wall hung lavatory 20 x 18 inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
   a. Drilling Centers: 4 inch.

C. Supply Faucet:
1. Trim: Chicago Model 802-VE39VP317ABCP combination sink fitting, mixing faucet, 4" centers, No. 317 - 4 inch blade handles, 0.35 GPM flow restrictor, ASME A112.18.1M; chrome plated brass supply with standard spout.
2. ADA accessible.

D. Accessories:
1. Chrome plated 17 gage brass P-trap and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
   a. Manufacturers:
      1) J.R. Smith.
   b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.9 SINKS (S-1)

A. Manufacturers:
1. Elkay

B. Single Compartment Bowl:

1. ASME A112.19.3M; 25 x 17 x 6-1/2 inch (635 x 430 x 165 mm) outside dimensions, 20 gage, Type 302 stainless steel, self rimming and undercoated, with ledge drilled for trim. Elkay CDKAD-2517VRC. Disabled accessible.
    a. Drain: 3" (76 mm) chromed brass perforated grid strainer and 1-1/2" O.D. tailpiece, vandal resistant, Elkay LK-18.

C. Trim: Elkay Model LK-VR-2085-13-LC, single handle deck mount, 1-hole installation, 13" high rigid gooseneck spout, vandal resistant aerator, wing handle, ASME A112.18.1M; chrome plated brass supply, anti-rotation pins.

D. Bubbler: Elkay LK-VR-1141-A no lead Flexi-Guard bubbler with anti-rotation feature.

E. Accessories: Chrome plated 17 gage (1.3 mm) brass P-trap and arm with escutcheon, screwdriver stops, rigid supplies.

2.10 SINKS (S-2)

A. Manufacturers:
1. Elkay

B. Single Compartment Bowl:
1. ASME A112.19.3M; 22 x 19 x 6 inch outside dimensions, 18 gage (0.9 mm) thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim. Elkay LRAD 2219. Disabled accessible.
    a. Drain: 3" (76 mm) chromed brass perforated grid strainer and 1-1/2" O.D. tailpiece, Elkay LK18.

C. Trim: Elkay Model 350-E35VP317XKABCP, single handle deck mount, 1-hole installation, gooseneck spout, 1.5 gpm aerator, 4" wrist blade handle, ASME A112.18.1M; chrome plated brass. ADA compliant.

D. Accessories: Chrome plated 17 gage (1.3 mm) brass and arm with escutcheon, loose key handle stops, rigid supplies.

2.11 DRINKING FOUNTAINS

A. Drinking Fountain Manufacturers:
1. Haws Drinking Faucet Company; Model 1119.
2. Elkay Manufacturing Company: www.elkay.com.
3. Halsey Taylor: www.halseytaylor.com.
4. Sunroc.
5. Oasis.
6. Approved equal.

B. Fountain:
1. "Hi-Lo" 18 gage, Type 304, No. 4 satin finish stainless steel, two dual height one pieces fountains with rounded bowls. Polished chrome plated brass, shielded, anti-squirt, vandal resistant bubbler heads. Push button activation. In-line strainer, waste strainers and traps. Vandal resistant bottom plates and matching stainless steel back panel. ADA accessible.
2. Mounting: Provide with Haws Model 6700.4 mounting plate with all thread studs, nuts and washers.
3. Support Carrier: Provide with Haws Model 6800 in-the-wall studs.

2.12 SERVICE SINKS (SS-1)

A. Service Sink Manufacturers:
1. Florestone
2. Fiat TSB-3000.
3. Williams.

B. Bowl: 24 x 24 x 12 inch (600 x 600 x 300 mm) high one piece precast terrazzo. Shoulders shall not be less than 2" wide with 1/2" pitch towards inside with stainless steel cap. Stainless steel cast integral drain body and stainless steel strainer.

C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout with pail hook, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Chicago 897.

D. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger. Fiat 889-CC.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PROTECTION

A. Protect fixtures and equipment from damage. Replace damaged items with new.

B. Keep pipe openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or plumbing damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of the work.

C. Protect bright finished shafts, bearing housings and similar items, until in service; no rust will be permitted.

D. Cover equipment and materials stored on the job site or otherwise suitably protect at the direction of, and to the satisfaction of Architect. If coverings become torn, replace until the equipment is connected and operating.

3.3 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.4 INSTALLATION - GENERAL

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 05, color to match fixture.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.5 FIXTURES INSTALLATION

A. General:
   1. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes.
   2. Verification of Conditions: Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.

3. Set and connect to soil, waste, vent and water piping in neat, finished and uniform manner. Connections to be equal height, plumb and set at right angles to floor, or both unless otherwise required or specified.
4. Seal fixtures mounted on floors and walls at abutting joints with approved sealant compounds as directed by Architect.
5. For ADA accessible toilets, provide with handle at wide portion of stall.
6. Lavatories: Set mixing valves to limit outlet temperature to 110F.

B. Fixture Locations: As shown on Drawings. Center water closets and urinals between privacy partitions unless noted otherwise.

C. Stops: Stops installed in each supply pipe at each fixture accessibly located with stops of loose key type. Concealed stops to be screwdriver or loose key type with wall escutcheons.

D. Fixture Supports:
1. Support wall hung water closets, urinals and lavatories on heavy duty, full size, concealed, commercial grade chair carriers mounted to floor structure. Refer to plumbing fixture connection schedule on drawings.
2. Support other fixtures mounted on stud partitions on heavy concealed wall brackets bolted to a 1/4-inch thick by 5-inch high steel plate anchored firmly to studs with bolts (or welded to metal studs). Plate to extend one stud each way beyond fixture mounting point width.

E. Flush Valves: Provide "drop-ear" ells or couplings in wall at water supply outlets to flush valves; anchor firmly to structure. At ADA accessible fixtures, face handle to wide portion of stall.

F. After fixtures are set in place and secured to walls, caulk around between fixtures and wall with white silicone caulking compound. Dow Corning 780, General Electric Construction Sealant, or approved.

G. Set countertop lavatories and stainless steel sink rims in waterproof sealant made for application.

H. Adjust self-closing faucets to provide minimum of 10 seconds of waterflow, and maximum of 15 seconds.

I. After fixture installation is complete, cover and protect rims, fronts and exposed parts until completion of construction phase. Contractor to be responsible for damage to fixtures and assumes related fixture repair or replacement costs.

J. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.

K. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner.

L. Field Quality Control:
1. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
2. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect. Remove cracked or dented units and replace with new units.

M. Adjusting and Cleaning: Piping: Clean piping exterior surfaces. Comply with Section 22 07 19, Insulation, as applicable. Flush out water filled or drainage piping systems with clean water.

N. Hose Bibb Piping: Provide each hose bibb with an individual accessible shutoff valve (ball type). Locate where shown on Drawings. Provide full access.

3.6 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

END OF SECTION

# SECTION 23 05 10 - MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References.

B. Description of Work.

C. Drawings and Specifications.

D. Industry Standards and Codes.

E. Site Examination.

F. Permits, Fees and Utility Connections.

G. Coordination of Work.

H. Progress of Work.

I. Submittals

J. Operation and Maintenance Manuals.

K. Project Record Documents.

L. Warranty.

M. Quality and Care

N. Access Doors.

O. Starting Equipment and Systems.

1.2 RELATED SECTIONS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.

C. The requirements of this Section apply to all Work of Divisions 22 and 23.

D. Section 01 33 00 - Submittals.

E. Section 01 40 00 - Quality Requirements.

F. Section 01 77 00 - Closeout, for closeout submittals.

1.3 DEFINITIONS

A. Following is a list of abbreviations generally used in Division 23:

1. ADA Americans with Disabilities Act
2. AHJ Authority Having Jurisdiction
3. ANSI American National Standards Institute
4. ARI Air-Conditioning & Refrigeration Institute
5. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
6. ASME American Society of Mechanical Engineers
7. ASTM American Society for Testing and Materials
8. ASSE American Society of Sanitary Engineering
9. AWWA American Water Works Association
10. CBC California Building Code
11. CEC California Electrical Code
12. CMC California Mechanical Code
13. CPC California Plumbing Code
14. CGA Canadian Gas Association
15. CISPI Cast Iron Soil Pipe Institute
16. CSA Canadian Standards Association

17. ETL Electric Testing Laboratories
18. FM FM Global
19. HI Hydraulic Institute Standards
20. HVAC Heating, Ventilating and Air Conditioning
21. MSS Manufacturers Standardization Society
22. NEC National Electric Code
23. NEMA National Electrical Manufacturers Association
24. NFPA National Fire Protection Association
25. NFGC National Fuel Gas Code
26. NRCA National Roofing Contractors Association
27. NSF National Sanitation Foundation.
28. OSHA Occupational Safety and Health Administration
29. SMACNA Sheet Metal and Air Conditioning Contractors' National Association, Inc.
30. TEMA Tubular Exchanger Manufacturers Association
31. TIMA Thermal Insulation Manufacturers Association
32. UL Underwriters Laboratories Inc.
33. UPC Uniform Plumbing Code

B. Provide: To furnish and install, complete and ready for the intended use.

C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly and installation.

D. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site as required to complete items of work furnished by others.

1.4 REFERENCES

A. ANSI - American National Standards Institute.

B. ASTM - American Society for Testing Materials.

C. CEC - California Electric Code.

D. NEMA - National Electric Manufacturers' Association.

E. NFPA - National Fire Protection Association.

F. OSHA - Occupational Safety and Health Act.

G. UL - Underwriters' Laboratories.

H. See detailed References that are listed in individual sections.

1.5 DESCRIPTION OF WORK

A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Mechanical System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.

B. The work shall also include the completion of details of mechanical work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.6 DRAWINGS AND SPECIFICATIONS

A. A. Where Contract Documents are at variance with applicable codes governing work, code and local jurisdiction requirements take precedence, and include cost necessary for code compliance or local jurisdiction compliance in bid price. Machinery and equipment to comply with Occupational Safety and Health Act of 1970, as currently revised, as interpreted for equipment manufacturer requirements.

B. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, ductwork and other mechanical work. Drawings are not intended to show

every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., ducts and piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than basis of design, including but not limited to architectural, structural, electrical, HVAC, fire sprinkler, and plumbingUse judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.

C. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

D. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.

E. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.7 INDUSTRY STANDARDS AND CODES

A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.

B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.

1. California Building Code, 2016.
2. California Mechanical Code, 2016.
3. California Plumbing Code, 2016.
4. California Electrical Code, 2016.
5. National Fire Protection Association.
6. California Fire Code, 2016.
7. California State Fire Marshal.
8. Occupational Safety and Health Administration, including CAL-OSHA.
9. State of California Energy Conservation Standards.
10. State of California Code of Regulations, Title 24.
11. Other applicable state laws.

C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

D. No material or product installed as a part of the Work shall contain asbestos in any form.

1.8 SITE EXAMINATION

A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.9 PERMITS, FEES AND UTILITY SERVICES

A. Contractor shall pay for and obtain all permits and service required in the installation of this work.

B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.10 COORDINATION OF WORK

A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.

B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions. Install this work in harmony with other crafts and at proper time to avoid delay of work.

C. Arrange mechanical work in a neat, well-organized manner with the piping, ductwork and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.

D. Verify the location of all equipment, air distribution devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

E. Execute any work or apparatus shown on the drawings and not mentioned in the specifications, or vise versa, the same as specifically mention by both. Omission from drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve this contractor from furnishing same in place complete.

F. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

G. Furnish materials and work at proper time to avoid delay of the work.

1.11 PROGRESS OF WORK

A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

1.12 EXISTING SOILS CONDITIONS

A. Understand existing soils conditions before submitting bid on work. No additional allowance will be granted due to lack of information for existing conditions of subsurface soils.

B. Submission of a bid will be considered acknowledgment of review/understanding of project geotechnical soils report.

1.13 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Mechanical systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.

B. Contractor shall design seismic bracing for all mechanical equipment and systems to comply with the 2016 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".

1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
2. Drawings, details and calculations shall be submitted to the Engineer for review. Compliance documents shall be approved by the Engineer prior to installation.

C. Mechanical systems and equipment shall include, but are not limited to, all ductwork, piping, air conditioning equipment, heating and ventilating equipment, air handlers, fans, electrical and control panels, conduits and other components.

D. Supports, anchorage and restraints for all piping and ductwork for standard installation details that comply with the latest edition of the latest edition of the Mason Industries "Seismic Restraint Guidelines", or equal, shall be used wherever possible. The Contractor shall provide all supporting documentation required for the Engineer and the reviewing authorities. If compliance with one of these standards is demonstrated, separate structural calculations are not required.

E. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.14 SUBMITTALS

A. See Section 01 33 00 - Submittals, for additional submittal procedures.

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Notice to Proceed.
   2. For products specified only by reference standards, list applicable reference standards.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project.

E. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.

F. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

G. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

H. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.

I. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

1.15 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Architect will consider requests for substitutions only within 7 days after date of Agreement.

C. Substitutions will not be considered when a product becomes unavailable through no fault of the Contractor.

D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.

E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

F. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and Architect for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.

I. Substitution Submittal Procedure:
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The Architect will notify Contractor in writing of decision to accept or reject request.
4. Present each substitution individually. If a proposed substitute in not found to be acceptable, then the specified item shall be supplied.

1.16 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 77 00 Closeout for Operation and Maintenance Manual requirements.

B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.

C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
1. Ventilating Systems.
2. Air Conditioning Systems.
3. Temperature Controls Systems.
4. Motors.
5. Air Balance and Test Reports.

D. Provide manufacturer's model number, design data, capacities, etc. for each piece of mechanical equipment furnished as a part of the Work.

E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.

F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.

G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.

H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.17 PROJECT MODIFICATIONS

A. During the progress of construction, if such conditions arise that require revisions, modifications, or relocations to any mechanical equipment or materials incorporated in this

project, such alterations shall be immediately called to the attention of the Architect. Contractor shall then prepare necessary drawings showing proposed changes. Submit proposed changes for review by the Architect prior to actual revision work in the field.

B. Two sets of drawings showing all revisions shall be immediately presented to the Architect for his records. Maintain additional copies on the project as necessary to comply with “RECORD DRAWINGS” requirement of the General Requirements.

C. Incorporate all revisions into record drawings.

1.18 PROJECT RECORD DOCUMENTS

A. See Section 01 77 00 - Closeout for Project Record Document requirements.

B. Record Drawings:
   1. Show changes and deviations from the Drawings. Include issued Addendum and change order items.
   2. Make changes to the Drawings in a neat, clean, and legible manner.

1.19 QUALITY ASSURANCE

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

H. Permits and Inspections:
   1. Unless otherwise distinctly hereinafter specified, apply and pay for necessary permits, plans check, and inspections required by public AHJ.
   2. Refer to General and Supplementary Conditions for payment of water and sewer service connection fees.
   3. Obtain certificates of inspection from AHJs and deliver to Owner before final acceptance.
   4. Each trade to consult local building department and utility companies prior to commencement of work to ascertain existence and location of existing underground utilities. Protect existing service against damage and interruption of use, and reroute as may be necessary to accomplish new work. Include costs for materials and installation for rerouting as specified for new work in bid price.

I. Regulatory Requirements:
   1. UL and CSA Compliance: Provide units which are UL and CSA listed.
   2. ASME Compliance: Provide units which are ASME listed when water heaters and boilers which exceed 200,000 BTUH, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

1.20 WARRANTY

A. See Section 01 78 36 - Warranties, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 QUALITY AND CARE

A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. Materials are to be UL or CSA approved or acceptable by state, county, and city authorities. Equipment supplier is responsible for obtaining state, county, and city acceptance on equipment not UL approved or not listed for installation. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).

B. HAZARDOUS MATERIALS
   1. Do not use products containing asbestos, lead, arsenic, or any other material defined by EPA as hazardous to human or animal life.

C. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.

D. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.

E. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

F. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

G. Inspect and report concealed damage to carrier within their required time period.

H. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.

I. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.2 ACCESS DOORS

A. Coordinate access door requirements with Section 08 31 13. The more stringent requirements shall govern.

B. Provide access doors where access through floors, walls or ceilings is required to access mechanical, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.
   1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
   2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.

C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
   1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
   2. Concealed hinges to allow 175 degree opening.
   3. Locks: flush, screw driver operated cam lock(s).
   4. Provide anchoring devices suitable for the construction into which the doors are framed.

D. Application (as applicable):
   1. In gypsum drywall walls and ceilings: Type DW.
   2. In ceramic tile walls: Type MS (stainless steel).

3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

PART 3 EXECUTION

3.1 NOISE AND VIBRATION

A. Install vibration isolators, flexible connectors, expansion joints, and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.

B. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.

3.2 SEISMIC CONTROL

A. Provide the following:
1. General:
a. Earthquake resistant designs for mechanical equipment, i.e., air handling units, water heaters, blowers, motors, ductwork, mechanical and plumbing piping, to conform to regulations of CBC.
b. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment piping, ductwork, and the like, to withstand a force in direction equal to value defined in CBC.
c. Retain licensed structural engineer to provide shop drawings of seismic bracing and seismic movement assemblies for piping/ ductwork/ equipment/ water heaters, and the like. Engineer to design and provide stamped shop drawings for equipment, ductwork, water heaters, piping seismic bracing, and the like. Submit shop drawings along with equipment submittals.
d. Retain licensed structural engineer to provide shop drawings of seismic flexible joints for piping/ductwork and the like crossing building expansion or seismic joints. Engineer to design and provide stamped shop drawings for piping/ductwork flexible seismic joints. Coordinate actual design deflection or travel with project structural engineer. Submit shop drawings along with seismic bracing details. Coordinate exact design requirements from project structural engineer.
2. Piping and Ductwork:
a. Use "Seismic Restraints Manual Guidelines for Mechanical Systems," published by SMACNA.
b. Sway bracing is not required for pipes that are installed on very short individual hangers (12 inch or less).
c. As approved by code authority, use a bracing system manufactured by Tolco, Superstrut, Mason, or Pipe Shields Inc. or approved.
3. Equipment:
a. Provide a means to prohibit excessive motion of mechanical equipment during earthquake.
b. Provide mechanical equipment, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to 0.5 of equipment operating weight.

3.3 REVIEW BY ENGINEER

A. Notify Architect/Engineer, in writing, at following stages of construction so that Architect/Engineer may, at their option, visit site for review and construction observation:
1. Plumbing:
a. Underground piping installation prior to backfilling.
b. Prior to covering walls.

c. When ceiling installation is started.
d. When main systems, or portions of, are being tested and ready for inspection by AHJ.

2. HVAC:
   a. When ductwork installation starts.
   b. When installation starts for each different major type of equipment.
   c. When ceiling installation is started.
   d. When lines or ducts are to be permanently concealed by construction or insulation systems.
   e. When balancing and testing is started.

3.4 MUTILATION

A. Repair mutilation of building around pipes, ducts, fixtures, and the like.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown in Contract Documents is provided. Where equipment requires piping arrangement, control diagrams, or sequencing different from that indicated in Contract Documents, provide electrical motors, wiring, controls, or other required electrical components at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and equipment in a manner to prevent damage and deterioration. Store in original container which identifies manufacturer's name, brand and model number. Do not store indoor equipment outdoors unless provided with a waterproof protective cover.

B. Replacement: In event of damage, immediately make repairs and replacements necessary.

3.7 CLEANING

A. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated by this work.

3.8 INSTALLATION

A. A. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level, firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

B. Access Doors
   1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
   2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
   3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
   4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
   5. Install in accordance with manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with the requirements within this section.

B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.10 TESTING AND INSPECTION

A. See individual specification sections for additional testing and inspection required.

B. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.11 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic, duct and gas piping testing.
1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.

B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
1. Refrigerant Liquid: Pressure=300 Psig. / Medium=Dry Nitrogen / Duration=4 Hours.
2. Refrigerant Suction: Pressure=150 Psig. / Medium=Dry Nitrogen / Duration=4 Hours.

3.12 CUTTING AND PATCHING

A. Submit written request in advance of cutting or alteration which affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new Products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.

I. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.13 PRIMING AND PAINTING

A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted.
   1. Primer shall be as recommended by the paint manufacturer for each specific application.
   2. Acceptable Products include: Rust-Oleum product, or equal. See Section 09 90 00 for other acceptable products.

B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except ductwork and piping, or factory primed or finished.

C. Preparation:
   1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
   2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
   3. Remove or protect hardware, electrical plates, mechanical grilles and louvers, lighting fixture trim, and other items not indicated to receive coatings which are adjacent to surfaces to receive coatings.
   4. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
   5. Galvanized Surfaces:
      a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.

b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.

6. Uncoated Steel And Iron Surfaces:
   a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
   b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
7. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:
1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Finish Painting: See Section 09 90 00.

3.14 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

A. For commissioning requirements see Section 01 91 00.

B. Start equipment and systems in accordance with manufacturer's written instructions..

C. Provide manufacturer's field representative to prepare and start equipment and systems.

D. Adjust for proper operation within manufacturer's published tolerances.

E. Demonstrate proper operation of equipment to Owner's designated representative.

F. Description:
1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
2. Coordinate all testing and startup procedures with all other trades so that all non-mechanical and non-electrical work is completed and operational so that the specified testing can be performed.

G. Preliminary Work:
1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
   a. Proper motor and fan/pump rotation.
   b. Flushing and cleaning of the system.
   c. Wiring
   d. Auxiliary connections
   e. Lubrication.
   f. Venting.
   g. Controls.
   h. Installation of filters and strainers.
   i. Setting of relief and safety valves .
2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
3. The Contractor shall submit at least 30 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Mechanical equipment. This schedule shall include work on a system by system, floor by floor basis.
4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not

only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.

a. The startup checklist will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment for equipment startup.

5. The Contractor shall schedule a tour with the Owner's representative to review startup conditions prior to equipment startup. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Owner's representative will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Owner's representative prior to attempting an equipment startup.
6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.

H. Startup and Commissioning:

1. System Startup and Operation:

a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.

b. The Contractor and the factory representative shall provide for the services of qualified factory representatives for all major equipment prestart setup, startup and initial operation. Such periods shall be sufficient to insure the proper operation of systems and equipment. Major equipment to include, but not limited to rooftop units, modular cooling units, temperature controls, fan systems, electrical systems, emergency power, fire alarm systems, and fire sprinkler, etc.

c. The Contractor shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for air and/or water flows throughout without blockages. Air handling systems shall be checked for proper damper connections and positions, aligned and adjusted belt drives, proper lubrication, temporary air filters installed, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.

d. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".

e. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, filter replacement, bearing lubrication, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

I. System Acceptance:

1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Owner requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.

J. Operation Test:

1. Provide all labor, equipment, and materials required to perform test.
2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
   a. Ability to control to new set point.
   b. Interface between systems, fire alarm/fire sprinkler systems.
   c. Proper sequence and operation.
   d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

3.15 GUARANTEE

A. Be responsible for work done and materials installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, materials, or part which may show itself within one year of filing of Notice of Completion and be responsible for damage to other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section.

C. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

3.16 ACCEPTANCE

A. System can not be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   1. Testing and balancing reports.
   2. Cleaning.
   3. System balancing and balancing logs.
   4. Operating and Maintenance Manuals.
   5. Training of operating personnel.
   6. Record Drawings.
   7. Guaranty certificates.
   8. Start-up and test document.
   9. Letter of conformance.

3.17 LETTER OF CONFORMANCE

A. Provide letter and copies of extended warranties with a statement in letter that mechanical items were installed in accordance with manufacturer's recommendations. Include letter of conformance and warranties in operating and maintenance manuals.

B. Warranties to begin at date of substantial completion.

END OF SECTION

# SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.

C. NEMA MG 1 - Motors and Generators; 2014.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for HVAC use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Conform to NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7 WARRANTY

A. See Section 01 78 36 - Warranties, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Leeson Electric Corporation: www.leeson.com.

B. Century Electric Co.

C. General Electric.

D. Gould Inc.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

B. Motors: Energy efficient, suitable for nonoverloading operation, and capable of continuous operation at full nameplate rating. Motors 1 HP and larger must meet Energy Policy act of 1992. Motors to be high efficient type similar to Century/Gould E-plus.

C. Take NEMA standards as minimum requirements for motor design and performance. Motors suitable for load, duty, voltage, frequency, hazard and for service and location intended. Motors, unless specified otherwise, to be general purpose open dripproof type, ball bearing equipped, 40C temperature rise; and rated for continuous duty under full load. Motors to have name plate giving manufacturer's name, shop number, HP, RPM and current characteristics.

D. Motors smaller than 1/2 horsepower, 1 phase; and motors 1/2 horsepower and larger, 3 phase and voltage as indicated on Drawings, unless otherwise noted. One phase motors to have internal thermal overload protection with automatic reset.

E. Provide two-speed motors where indicated on schedule or in sequence.

F. Construction:
   1. All motors shall be rated for continuous operation at 115% of nameplate amperage. Motors shall be selected to operate at less than nameplate amperage throughout the entire operating range. Match the motor nameplate voltage and phase ratings with the electrical service provided. Verify with the electrical drawings. Provide motors that operate at 1750 RPM, unless indicated otherwise on the drawings. Bearings shall be ball or roller type, sealed and permanently lubricated. Motors shall be open drip resistant unless indicated otherwise.
   2. Open drip-proof type except where specifically noted otherwise.
   3. Design for continuous operation in 40 degrees C environment.
   4. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

G. Provide single phase motors with built in overload protection.

H. NEMA Open Motor Service Factor shall be 1.15.

I. Provide motors that are compatible with motor starters provided.

J. Belt driven motors shall be provided with a foundation slide base and shaft, as required for aligning pulleys.

K. All equipment and connections exposed to the weather shall be NEMA 3R with factory wired strip heaters in each starter enclosure to prevent condensation.

L. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

M. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans: Split phase type.

C. Motors located in exterior locations: Totally enclosed type.

D. Motors used in conjunction variable frequency drives (variable speed motor controller) shall have Class F insulation as a minimum, and shall be rated for inverter duty per NEMA MG1-31, fully matched and compatible with the variable speed motor controller.

2.4 STARTERS

A. Single Phase Motors:
   1. Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.
   2. Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be nonoperative if thermal unit is removed.
   3. Single phase motors with automatic controls. Provide motor rated relay with coils rated for control voltage.

B. Starters up to size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils, and relays to perform the control functions of the associated equipment and control sequence.

C. Three phase motors up to and including 15 HP:
   1. Provide enclosed type magnetic across-the-line starter with thermal overload and under voltage protection.
   2. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified. Then provide "Hand-Off-Auto" selector switch.
   3. Starters for 3 phase motors to have overload protection in each of the three legs, with external manual reset.
   4. Unless indicated on Drawings or in Specifications, furnish motor starters with a neon pilot light. Neon lights are required for exhaust fan switches.
   5. Equip starters with integral transformer and coil for control circuit. Coordinate coil voltage with control voltage.

D. Motor starters for equipment not installed in Division 26, Section "Motor Control Center" to be furnished and installed by Division 23.

2.5 DISCONNECTS

A. Provided by Division 26 unless otherwise specified.

2.6 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.7 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

PART 3 EXECUTION

3.1 MECHANICAL ELECTRICAL COORDINATION

A. Factory wired equipment shall have all wiring, starting and control equipment supplied and installed with motors, unless noted otherwise on Drawings.

B. Coordinate with Division 26 for installation of motor controllers furnished under this section.

C. Motor starters that are required to start and control equipment that are not factory wired shall be furnished and installed by Division 26.

3.2 ELECTRICAL REQUIREMENTS

A. Provide required working space around electrical equipment in compliance with National Electric Code. Coordinate mechanical work with the electrical work to comply.

B. Furnish and set in place all motors. Furnish necessary control diagrams and instructions for controls. Review all associated electrical work, including overload protection devices before permitting the operation of any equipment furnished installed or modified under this Section.

C. All power wiring, fuses, thermal overloads, disconnect switches and connection of all motors are under Division 26 unless noted otherwise on Drawings. All wiring and conduit associated with Temperature Control Systems are included in this Section. Wiring and conduit shall comply with Division 26.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

# SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units, Fan Coil Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Dampers: Ceiling tacks, where located above lay-in ceiling.

F. Ductwork: Stencilled painting.

G. Instrumentation: Tags.

H. Major Control Components: Nameplates.

I. Piping: Pipe markers.

J. Thermostats: Nameplates.

2.2 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

2.3 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height, Equipment, control panels: 1 inch.
3. Letter Height, Thermostats and small control components: 1/4 inch.
4. Background Color: Black.

2.4 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.5 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. Ductwork: Minimum 1-1/4 inch high letters.

B. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors conforming to ASME A13.1.

2.6 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completly around pipe and overlapped.

2.7 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 91 23.

D. Identify air conditioning units and exhaust fans with plastic nameplates.

E. Identify control panels and major control components outside panels with plastic nameplates.

F. Identify thermostats relating to terminal boxes or valves with nameplates.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

# SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Commissioning activities.

1.2 RELATED REQUIREMENTS

A. Section 01 91 00 - Commissioning: Commissioning requirements that apply to all types of work.

B. Section 23 08 00 - Commissioning of HVAC.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

C. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

D. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

E. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit to the Commissioning Authority.
3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
4. Include at least the following in the plan:
   a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
   b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
   c. Identification and types of measurement instruments to be used and their most recent calibration date.
   d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
   e. Final test report forms to be used.
   f. Detailed step-by-step procedures for TAB work for each system and issue, including:
      1) Terminal flow calibration (for each terminal type).
      2) Diffuser proportioning.
      3) Branch/submain proportioning.
      4) Total flow calculations.
      5) Rechecking.
      6) Diversity issues.
   g. Expected problems and solutions, etc.
   h. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.

i. Details of how TOTAL flow will be determined; for example:
   1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
   2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
m. Method of checking building static and exhaust fan and/or relief damper capacity.
n. Methods for making coil or other system plant capacity measurements, if specified.
o. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
p. Procedures for formal progress reports, including scope and frequency.
q. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to the Commissioning Authority.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
   2. Revise TAB plan to reflect actual procedures and submit as part of final report.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   4. Provide electronic copy of reports and provide reports in soft cover binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   7. Units of Measure: Report data in I-P (inch-pound) units only.
   8. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Project name.
      d. Project location.
      e. Project Architect.
      f. Project altitude.
      g. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Test and balance shall be performed by an independent test and balance agency.

C. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org.

E. TAB Supervisor Qualifications: Certified by same organization as TAB agency.

3.2 TESTING, ADJUSTING, AND BALANCING AGENCIES

A. RS Analysis.

B. Raglen System Balance.

3.3 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.4 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

3.5 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.6 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.7 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.8 COMMISSIONING

A. See Sections 01 91 13 and 23 08 00 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-checkminimum outdoor air intake flows and maximum and intermediate total airflow rates for 30 percent of the air handlers plus a random sample equivalent to 30 percent of the final TAB report data as directed by Commissioning Authority.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
      e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
   3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.9 SCOPE

A. Test, adjust, and balance the following:
   1. Unit Air Conditioners.
   2. Air Coils.
   3. Terminal Heat Transfer Units.
   4. Air Handling Units.
   5. Fans.
   6. Air Filters.
   7. Air Terminal Units.
   8. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. HP/BHP.
   3. Phase, voltage, amperage; nameplate, actual, no load.

4. RPM.
5. Service factor.
6. Sheave Make/Size/Bore.

B. V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Air pressure drop, design and actual.

D. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air temperature, design and actual.
7. Leaving air temperature, design and actual.
8. Air pressure drop, design and actual.

E. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

F. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.

7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.

G. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

H. Duct Traverses:
1. Duct size.
2. Area.
3. Design velocity.
4. Design air flow.
5. Test velocity.
6. Test air flow.
7. Duct static pressure.
8. Air temperature.
9. Air correction factor.

I. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

# SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.3 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY **REQUIREMENTS**

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
1. Owens-Corning Fiberglas; Model [All Service Faced Duct Wrap].
2. Knauf Insulation: www.knaufinsulation.com.
3. Johns Manville: www.jm.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Duct Application: 2" thick, 3/4 pound density.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Secure with pressure sensitive tape.

2.3 DUCT LINER

A. Manufacturers:
1. Knauf Insulation: www.knaufinsulation.com.
2. Johns Manville: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
2. Duct Application (Indoors): 1" thick, 1-1/2 pound density.
3. Duct Application (Outdoors): 2" thick, 1-1/2 pound density.
4. Service Temperature: Up to 250 degrees F.
5. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

C. Liner Fasteners: Galvanized steel, welded with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

D. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.

2. Secure insulation with mechanical liner fasteners. Liner shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from the longitudinal joints, and shall be spaced at a maximum of 12 inches on center around the perimeter of the duct (except that they shall be a maximum of 12 inches from a corner break). Elsewhere, they shall be a maximum of 18 inches on center, except that they shall not be placed more than 6 inches from a longitudinal joint of the liner or 12 inches from a corner break. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
3. Seal and smooth joints. Seal and coat transverse and longitudinal joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are outside dimensions and include consideration for liner thickness.

3.3 SCHEDULES

A. Supply and Return Ducts: Insulate all unlined supply and return ducts, except ducts exposed in conditioned spaces.

B. Exhaust Ducts: Install lining where shown on drawings.

END OF SECTION

# SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY **REQUIREMENTS**

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell LLC; www.armacell.us.
2. Owens Corning Flex Tubing.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.
   2. Minimum Service Temperature: Minus 40 degrees F.
   3. Maximum Service Temperature: 220 degrees F.
   4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.
   5. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.
   6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
   1. Manufacturers:
      a. Armstrong Model 520.
      b. Owens Corning Model 500.

2.3 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.
      a. Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 SCHEDULE

A. Cooling Systems:
   1. Refrigerant Suction:
      a. Cellular Foam Insulation:
         1) Thickness: 0.75 inch.

END OF SECTION

# SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

A. See Section 01 91 13 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 91 13.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Ductwork and accessories.
   4. Variable frequency drives.
   5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED REQUIREMENTS

A. Section 01 77 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

D. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process; 2012.

1.4 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
   a. Floor.
   b. Room number.
   c. Room name.
   d. Air handler unit ID.
   e. Reference drawing number.
   f. Air terminal unit tag ID.
   g. Heating and/or cooling valve tag ID.
   h. Minimum air flow rate.
   i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
   a. Sequences of operation.
   b. Control drawings.
   c. Points lists.
   d. Controller and/or module data.
   e. Thermostats and timers.
   f. Sensors and DP switches.
   g. Valves and valve actuators.
   h. Dampers and damper actuators.
   i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 79 00 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with the contract documents.

3.2 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

A. See Section 07 78 23 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

A. See Section 01 79 00 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum 2 hours, after completion of TAB, on the following:
1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of 4 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 4 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

# SECTION 23 09 33 - FACILITY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 PRODUCT DESCRIPTION

A. The Facility Management System shall be Johnson Controls Metasys “Network Automation Engine” and capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving via browser by the existing Johnson Controls “ADS” Application and Data Server. No other manufacturers or systems will be considered. NO SUBSTITUTION.

B. The Facility Management System shall consist of the following:
   1. Standalone DDC panels
   2. Standalone application specific controllers. (ASCs)
   3. Personal Computer Operator Workstations.

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC panel shall operate independently by performing its own specified control, alarm management, operator I/O, and historical data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

D. Standalone DDC panels shall be able to access any data from, or send control commands and alarm reports directly to any other DDC panel or combination of panels on the network without dependence upon a central processing device. Standalone DDC panels shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

E. Installation: The Network Automation Engine (NAE) unit will be installed at or near the main distribution frame (MDF) at the school site. See plans for location.

1.2 NETWORKING / COMMUNICATIONS

A. The design of the FMS shall network operator workstations and Standalone DDC panels as shown on the architectural system configuration drawing. Inherent in the system's design shall be the ability to expand or modify the network via the local area network.

B. Local Area Network
   1. Workstation / DDC Panel Support: Operator workstations and DDC panels shall directly reside on a local area network such that communications may be executed directly between controllers, directly between workstations, and between controllers and workstations on a peer-to-peer basis.
   2. Dynamic Data Access: All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all point status and application report data, or execute control functions for any and all other devices via the local area network. Access to data shall be based upon logical identification of building equipment.
      a. Access to system data shall not be restricted by the hardware configuration of the Facility Management System. The hardware configuration of the FMS network shall be totally transparent to the user when accessing data or developing control programs.
   3. General Network Design: Network design shall include the following provisions:
      a. High-speed data transfer rates for alarm reporting, quick report generation from multiple controllers, and upload/download efficiency between network devices. The minimum baud rate shall be 2.5 Megabaud.
      b. Support of any combination of controllers and operator workstations directly connected to the local area network. A minimum of 50 devices shall be supported on a single local area network.
      c. Detection and accommodation of single or multiple failures of either workstations, DDC panels or the network media. The network shall include provisions for automatically reconfiguring itself to allow all operational equipment to perform their

designated functions as effectively as possible in the event of single or multiple failures.

1.3 STAND ALONE DDC PANELS

A. General: Stand alone DDC panels shall be microprocessor based, mullet-asking, multi-user, real-time digital control processors. Each stand alone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this specification and the attached point list.

B. Memory: Each DDC panel shall have sufficient memory to support its own operating system and database including:
   1. Control processes
   2. Energy Management Applications
   3. Alarm Management
   4. Historical/Trend Data for all points
   5. Operator I/O
   6. Manual Override Monitoring

C. Point Types: Each DDC panel shall support the following types of point inputs and outputs:
   1. Digital Inputs for Status/Alarm Contacts.
   2. Digital Outputs for on/off Equipment Control.
   3. Analog Inputs for Temperature
   4. Analog Outputs for Valve and Damper Position Control and
   5. Capacity Control of Primary Equipment.

D. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators.

E. Serial Communication Ports: Standalone DD. panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as industry standard printers, laptop workstations, PC workstations, and panel mounted or portable DD. panel Operator's terminals.

F. Hardware Override Monitoring: DDC panels shall monitor the status or position of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited. DDC panels shall also collect override activity information for daily and monthly reports.

1.4 SENSORS AND MISCELLANEOUS DEVICES

A. Temperature Sensors
   1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable. Wall sensors to be housed in tamperproof enclosures. Duct sensors to be electronically identical, housing suitable for the application. Metal guards shall be provided as shown on drawings.

B. Digital Display Wall Controller (DWC) / Temperature Sensor
   1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use-all within limits as programmed by building operator. Controller shall also allow service technician access to hidden functions as described in sequence of operation.
   2. Provide means to view The DWC shall simultaneously display room setpoint, room temperature and,outside temperature, and fan status (if applicable) at each controller and the discharge air temperature at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.

3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the DWC. Time remaining shall be displayed. Display shall show the word “OFF” in unoccupied mode unless a function button is pressed.
4. See sequence of operation for specific operation of DWC displays and function keys in field service mode and in normal occupant mode. Provide digital display wall controllers as specified in point list.
5. Field service mode shall be customizable to fit different applications. If DWC is connected to VAV controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the DWC.

C. Wall Sensor
1. Standard wall sensor shall use solid state sensor identical to DWC and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for setpoint adjustment and jack for plug-in of DWC for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All functions of DWC shall be available through wall sensor port.

1.5 DAMPERS AND ELECTRONIC DAMPER ACTUATORS

A. Dampers
1. Provide 5100 model parallel or opposed blade control dampers as manufactured by Vent Products. Blades to be 16 ga. V-reinforced galvanized steel. Welded frame to be Fasten E/Z press formed 14 ga. galvanized steel complete with fully adjustable linkage and control rods. Blades to be custom sized for maximum free area without blank-offs.

B. Electronic Damper Actuators
1. Actuator shall be direct coupled (over the shaft), enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator-to-shaft clamp shall use a “V” bolt and “V” shaped, toothed cradle to attach to the damper shaft for maximum holding strength. Single bolt or set screw type fasteners are not acceptable.
2. Actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator. End switches to deactivate the actuator at the end of rotation or magnetic clutch are not acceptable.
3. For power-failure/safety applications, a mechanical, spring return mechanism shall be used.
4. Actuators with spring return mechanisms shall be capable of either clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
5. Proportional actuators shall accept a 2-10VDC, 4-20mA signal, or be of the 2-point floating type and provide a 2-10VDC actuator position feedback signal.
6. All actuators shall have an external manual gear release (clutch) or manual crank to aid in installation and for allowing manual positioning when the actuator is not powered.
7. All actuators shall have an external direction of rotation switch to aid in installation and to allow proper control response.
8. Actuators shall be provided with a factory-mounted 3-foot electrical cable and conduit fitting to provide easy hook-up to an electrical junction box.
9. Actuators shall be listed under Underwriters Laboratories Standard 873 and Canadian Standards Association.

PART 2 - SYSTEM SOFTWARE FEATURES

2.1 GENERAL

A. All Necessary software to form a complete operating system as described in this specification shall be provided.

B. The software programs specified in this section shall be provided as an integral part of the DDC panel and shall not be dependent upon a higher-level computer for execution.

2.2 CONTROL SOFTWARE DESCRIPTION

A. Pre-Tested Control Algorithms: The DDC panels shall have the ability to perform the following pre-tested control algorithms:
   1. Two Position Control
   2. Proportional Control
   3. Proportional plus Integral Control
   4. Proportional, Integral, plus Derivative Control
   5. Automatic Control Loop Tuning

B. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycling within any one-hour period.

C. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start demands to heavy electrical loads.

D. Power fail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

2.3 ENERGY MANAGEMENT APPLICATIONS

A. DDC panels shall have the ability to perform any or all of the following energy management routines:
   1. Time of Day Scheduling
   2. Calendar Based Scheduling
   3. Holiday Scheduling
   4. Temporary Schedule Override
   5. Optimal Start
   6. Optimal Stop
   7. Night Setback Control
   8. Enthalpy Switchover (economizer)
   9. Fan Speed/CFM Control
   10. Heating/Cooling Interlock
   11. Cold Deck Reset
   12. Hot Deck Reset
   13. Hot Water Reset
   14. Chilled Water Reset
   15. Condenser Water Reset
   16. Chillier Sequencing

2.4 CUSTOM PROCESS PROGRAMMING CAPABILITY

A. DDC panels shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

B. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:
   1. Any system-measured point data or status
   2. Any calculated data
   3. Any results from other processes
   4. User-Defined constants
   5. Arithmetic functions (+, -, *, /, square root, exp., etc.)
   6. Boolean logic operators (and, or, exclusive or, etc.)
   7. On-delay / Off-delay / One-shot timers

C. Process Triggers: Custom processes may be triggered based on any combination of the following:
   1. Time interval
   2. Time of day

3. Date
4. Other processes
5. Time programming
6. Event (e. g., point alarms)

D. Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other DDC panels on the local area network.

2.5 ALARM MANAGEMENT

A. Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at a PC workstation or local I/O device, or, communications with other panels on the network.

B. Point Change Report Description: All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.

C. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

D. Report Routing: Alarm reports, email messages, and files will be directed to a user-defined list of operator devices, or PCs automatically directed to a default device in the event a primary device is found to be off-line.

E. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to email, display or store a 65-character alarm messages to more fully describe the alarm condition or direct operator response

2.6 HISTORICAL DATA AND TREND ANALYSIS

A. A variety of historical data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways.

B. Continuous Point Histories: Standalone DDC panels shall store Point History Files for all analog and binary inputs and outputs.

1. The Point History routine shall continuously and automatically sample the value of all analog inputs at half hour intervals. Samples for all points shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point History Files for binary input or output points and analog output points shall include a continuous record of the last ten status changes or command for each point.

C. Control Loop Performance Trends: Standalone DDC panels shall also provide high resolution sampling capability with an operator-adjustable resolution of 10-300 seconds in one-second increments for verification of control loop performance.

D. Extended Sample Period Trends: Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 2 hours, in one-minute intervals, shall be provided. Each standalone DDC panel shall have a dedicated buffer for trend data, and shall be capable of storing a minimum of 5000 data samples.

E. Data Storage and Archiving: Trend data shall be stored at the standalone DDC panels, and uploaded to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined interval, manual command, or when the trend buffers become full. All trend data shall be available in disk file form for use in 3rd party personal computer applications.

PART 3 - APPLICATION SPECIFIC CONTROLLERS

3.1 H.V.A.C. APPLICATIONS

A. Each stand alone DDC controller shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).

B. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor.

C. Each ASC shall have sufficient memory to support its own operating system and data bases including:
   1. Control Processes
   2. Energy Management Applications
   3. Operator I/O (portable service terminal)

D. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation, or and PC or portable operator's terminal connected to any DDC panel in the network.

E. Application Specific Controllers shall directly support the temporary use of a portable service terminal. The capabilities of the portable service terminal shall include but not be limited to the following:
   1. Display temperatures
   2. Display status
   3. Display set points
   4. Display control parameters
   5. Override binary output controls
   6. Override analog set points
   7. Modification of gains and offset

3.2 APPLICATION DESCRIPTIONS

A. Zone Thermostats – Shall be provided with “WARMER/COOLER” slide adjustment and allow occupants to modify temperature 1.5F above or below the current heat or cool set-point. Thermostats shall also have an override button or after hours feature.

B. Zone Set-points for all applications shall be: Occupied Set-points, Heat – 67.5 F, Cool – 75.5F, Unoccupied Set-points, Heat – 55F, Cool – 90F

C. Override Button – Shall allow for up to 60 minutes of after hours use.
   1. Override time allowed shall be:
   2. Office areas – 60 minutes
   3. Classrooms -- 30 minutes
   4. Gym/Multipurpose room 60 minutes

D. Supply Air Temp Sensor – All heating/cooling equipment shall be equipped with a supply air temperature sensor for monitoring/troubleshooting purposes.

E. Unitary Controllers
   1. Unitary Controllers shall support, but not be limited to, the following types of systems to address specific application described in the Execution portion of this specification, and for future expansion:
      a. Unit Vents (ASHRAE Cycle I, II, III or W)
      b. Heat Pumps (Air-to-Air, Water-to-Air)
      c. Packaged Rooftops
      d. Fan Coils (Two-Pipe, Four-Pipe)
   2. Unitary Controllers shall support the following types of point inputs and outputs:
      a. Economizer Switchover Inputs
         1) Dry bulb
         2) Outdoor Air Enthalpy
         3) Differential Temperature Binary Input from a separate controller

4) Economizer Outputs
   (a) Integrated
   (b) Analog with minimum position
   (c) Binary output to enable self-contained economizer actuator
5) Heating and Cooling
   (a) Outputs
   (b) 1 to 3 Stages
   (c) Analog Output with two-pipe logic
   (d) Reversing valve logic for Heat Pumps
   (e) Fan Output On/Off Logic Control

3. Unitary controllers shall support the following library of control strategies to address the requirements of the sequences described in the Execution portion of this specification, and for future expansion:
   a. Daily/Weekly Schedules
   b. Comfort / Occupancy Modes
   c. Economy Mode
   d. Standby Mode / Economizer Available
   e. Unoccupied / Economizer Not Available
   f. Shutdown
   g. Temporary Override Mode
   h. Temporary Comfort Mode
   i. (Occupancy-Based Control)
   j. Boost (Occupancy Warmer / Cooler Control)
4. Comfort Mode Control: Each Unitary Controller shall have a provision for occupancy sensing overrides. Based upon the contact status of either a manual wall switch or an occupancy-sensing device, the Unitary Controller shall automatically select either Standby or Comfort mode to minimize the heating and cooling requirements while satisfying comfort conditions.
5. Continuous Zone Temperature Histories: Each Unitary Controller shall automatically and continuously, maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.

PART 4 - OPERATOR INTERFACE

4.1 BASIC INTERFACE DESCRIPTION:

A. Microsoft Internet Explorer 6.0 shall be used to access all sites. No proprietary Workstation software of proprietary software licensing shall be required to access any supervisory controller at the school site. The supervisory controller shall have full programmability embedded to add/remove/delete controllers, objects, features or other supervisory controllers via the Browser.

B. Multiple, Concurrent Displays: The Operator Interface shall provide the ability to simultaneously view several different types of system displays in overlapping windows to speed building analysis. For example, the interface shall provide the ability to simultaneously display a graphic depicting an air-handling unit, while displaying the trend graph of several associated space temperatures to allow the user to analyze system performance. If the interface is unable to display several different types of displays at the same time, the FMS contractor shall provide at least two operator stations.

C. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
   1. Passwords shall be exactly the same for all operator devices, including portable or panel-mounted network terminals. Any additions or changes made to password definition shall automatically cause passwords at all DDC panels on a network to be updated and

downloaded to minimize the task of maintaining system security. Users shall not be required to update passwords for DDC panels individually.

2. A minimum of five levels of access shall be supported:
   a. Level 1 = Data Access and Display
   b. Level 2 = Level 1 + Operator Overrides
   c. Level 3 = Level 2 + Database Modification
   d. Level 4 = Level 3 + Database Generation
   e. Level 5 = Level 4 + Password Add/Modification
   f. A minimum of 50 passwords shall be supported at each DDC panel.
   g. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, including portable or panel mounted devices, shall be limited to only those items defined for the access level of the password used to log-on.

D. Operator Commands: The operator interface shall allow the operator to perform commands remotely including, but not limited to, the following:
   1. Start-up or shutdown selected equipment
   2. Adjust set points
   3. Add/Modify/Delete time programming
   4. Enable/Disable process execution
   5. Lock/Unlock alarm reporting for each point
   6. Enable/Disable Totalization for each point
   7. Enable/Disable Trending for each point
   8. Enter temporary override schedules
   9. Define Holiday Schedules
   10. Change time/date
   11. Entry/Modify analog alarm limits
   12. Enter/Modify analog warning limits
   13. View limits

E. Logs and Summaries: Reports shall be generated automatically or manually, and directed to either CRT displays, printers, or disk files. As a minimum, the system shall allow the user to easily obtain the following types or reports:
   1. A general listing of all points in the network
   2. List all points currently in alarm
   3. A general listing of all points in the network
   4. List all points currently in alarm
   5. List of all off-line points
   6. List all points currently in override status
   7. List of all disabled points
   8. List all points currently locked out
   9. List of all items defined in a “Follow-Up” file
   10. List all Weekly Schedules
   11. List all Holiday Programming
   12. Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

4.2 COLOR GRAPHIC DISPLAY

A. Color graphic floor plan displays shall be provided.

B. Site Plan: A graphic showing all buildings of a school site shall be provided.

C. Building: Each building within a site shall show individual classrooms by room name or number. Room Identification shall be verified by the controls contractor on site.

D. Displays: Each room within a building shall show the current zone temperature value.

4.3 SYSTEM CONFIGURATION AND DEFINITION

A. All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
   1. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:
   2. Add/Delete/Modify Standalone DDC Panels
   3. Add/Delete/Modify Standalone DDC Panels
   4. Add/Delete/Modify Operator Workstations
   5. Add/Delete/Modify Application Specific Controllers
   6. Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants
   7. Add/Delete/Modify alarm reporting definition for each point
   8. Add/Delete/Modify control loops
   9. Add/Delete/Modify energy management applications
   10. Add/Delete/Modify time- and calendar-based programming
   11. Add/Delete/Modify Totalization for every point
   12. Add/Delete/Modify Historical Data Trending for every point
   13. Add/Delete/Modify custom control processes
   14. Add/Delete/Modify any and all graphic displays, symbols, and cross-references to point data
   15. Add/Delete/Modify dial-up telecommunication definition
   16. Add/Delete/Modify all operator passwords
   17. Add/Delete/Modify Alarm Messages

B. Programming Description: Definition of operator device characteristics, DDC panels, individual points, applications and control sequences shall be performed through fill-in-the-blank templates and graphical programming approach.
   1. Graphical Programming: Control sequences are created by using a mouse input device to draw interconnecting lines between symbols depicting inputs, operators (comparisons and mathematical calculations), and outputs of a control sequence. As a minimum, graphic symbols shall be used to represent:
      a. Process Inputs, such as temperature, humidity, or pressure values, status, time, date, or any other measured or calculated system data.
      b. Mathematical Process Operators, such as addition, subtraction, multiplication, or greater than, equal to, less than, etc.
      c. Time Delays
      d. Process Control Outputs such start/stop control points, analog adjust points, etc.
      e. Process Calculation Outputs
      f. Text file Outputs and Advisories
   2. Network-Wide Strategy Development: Inputs and outputs for any process shall not be restricted to a single DDC panel, but shall be able to include data from any and all other DDC panels to allow the development of network-wide control Strategies. Processes shall also allow the operator to use the results of one process as the input to any number of other processes (cascading).
   3. Sequence Testing and Simulation: A software tool shall be provided, which allows a user to simulate control sequence execution to test strategies before they are actually applied to mechanical systems. Users shall be able to enter hypothetical input data, and verify desired control response and calculation results via graphical displays and hardcopy printouts.

C. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hardcopy printouts of all configuration and application data. Control process and DDC control loop documentation shall be provided in logical, graphical flow diagram format to allow control sequences to be easily interpreted and modified at any time in the future.

4.4 LAPTOP PC WORKSTATION DESCRIPTION:

A. Laptop Personal Computer Operator Workstations shall be provided for command entry, alarm management, information management, and database management functions shall be resident in the Standalone DDC panels to facilitate greater fault tolerance and reliability.

B. Laptop PC Operator Workstations shall be general purpose, commercially available, personal computers with sufficient memory and processor capacity to perform all functions described in this specification and shall included a 9 pin serial port.

C. The Laptop display shall have a diagonal screen measurement of no less than 9", and a minimum display resolution of no less than 640 X 320 pixels. The screen shall be non-reflective.

D. The DDC panel Operator Terminal shall provide access to all real or calculated points in the controller to which it is connected, or any other controller in the network. This capability shall not be restricted to a subset of predefined "global points", but shall provide totally open exchange of data between the operator terminal and any DDC panel in the network.

E. Operator access at all DDC panel Operator Terminals shall be identical to each other, as well as identical to the PC or Laptop Operator Workstations, Any password changes shall automatically be downloaded to all controllers on the network

F. The DDC panel operator terminal shall provide English language prompting to eliminate the need for the user to remember command formats or point names. Prompting shall be provided consistent with a user's password clearance and possibility of operator error.

G. A multi-function touchpad shall be provided for point and command selection, as well as parameter entry. To minimize the possibility of operator error, the DDC panel Operator Terminal shall change and limit touchpad functions based upon an operator's password clearance, the function being performed, and types of points being displayed. Screen displays shall clearly indicate only valid touchpad functions.

H. Identification for all real or calculated points shall be consistent for all network devices. The same English language names used at PC workstations shall be used to access points at the DDC panel Operator's Terminal to eliminate cross-reference or look-up tables.

END OF SECTION

# SECTION 23 23 00 - REFRIGERATION, PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and General Requirements (Sections of Division 1) are hereby made a part of this Section.

B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 WORK INCLUDED

A. Extent of refrigeration piping is indicated on Drawings and provisions of this section, including schedules and equipment lists associated with either Drawings or this section.

1.3 QUALITY ASSURANCE

A. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.

1.4 SUBMITTALS

A. REQUIREMENTS: Submit manufacturer's technical product data and installation instructions for refrigeration piping systems.

PART 2 - MATERIALS

2.1 REFRIGERATION SYSTEM REQUIREMENTS

A. Furnish and install all interconnecting refrigeration piping as shown and/or required. Piping shall be run in accordance with equipment manufacturer's recommendations. Pipe sizes shall be as recommended by equipment manufacturer. Test all refrigeration piping for leaks with an electronic leak detector. Seal and flash all roof and wall penetrations. Provide plastic pipe shields between pipe and hanger. Pitch suction piping down in direction of flow.

B. REFRIGERANT PIPING: Type L hard copper refrigerant tubing cleaned and capped with wrought copper solder joint fittings and couplings. All joints shall be brazed.

C. All stop valves shall be Henry, or approved equal, bronze diaphragm, packless type, solder ends. Sight glass shall be Henry Dri-Vue or approved equal.

D. Refrigerant suction piping exposed to weather shall be insulated with 3/4-inch thick Armstrong Armaflex foamed plastic pipe insulation. Fittings and valves shall be covered with segmented sections on the pipe insulation installed in accordance with manufacturer's published instructions. All joints between sections of insulation shall be sealed with Armstrong No. 520 adhesive. The exterior of all exposed insulation shall be given two brush coats of Armstrong "Finish".

E. Insulate concealed refrigerant piping with 1/2-inch thick, 4-lb. nominal density glass fiber insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF REFRIGERANT PIPING

A. The refrigeration system shall be vacuum pumped, proven tight, and then charged with refrigerant from factory-sealed containers. All piping shall be properly purged with dry nitrogen and completely evacuated, dehydrated, and leak tested in accordance with manufacturer's recommendations. Compressor crankcases shall be filled with dehydrated, wax-free lubricating oil.

B. Test refrigeration suction piping at 150 lbs. and 25-inch vacuum with nitrogen or freon. Test refrigeration liquid piping at 300 lbs. and 25-inch vacuum with nitrogen or freon.

END OF SECTION

# SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 23 07 13 - Duct Insulation: External insulation.

C. Section 23 33 00 - Air Duct Accessories.

D. Section 23 37 00 - Air Outlets and Inlets.

E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

C. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.4 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 2 inch pressure class and higher systems. Provide 1/4"=1'-0" ductwork layout plans showing duct routing, offsets, fittings, duct accessories, fire/smoke dampers, hydronic piping, seismic bracing, etc. Shop drawings shall by fully coordinated with all other trades, including the building structure, finishes, fire sprinkler piping, plumbing piping, hydronic piping and electrical systems.

D. Duct Leakage Testing: Ductwork shall be sealed and tested for air leakage in accordance with the 2013 California Energy Commission Non-Residential Compliance Manual.

E. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following the 2013 California Energy Commission Non-Residential Compliance Manual and the SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years ofdocumented experience.

1.7 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

2.2 MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discoloration, and other imperfections, including those which would impair painting.

B. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

C. Round supply ductwork and fittings shall be spiral lockseam equal to “United McGill” Uni-Seal duct.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of ductwork.

E. Insulated Flexible Ducts:

1. Flexible ducts shall be U.L. listed and shall comply with UMC Standard 6-1.
2. Flexible ducts shall have a flame spread index of not more than 25 and a smoke-density index not exceeding 50 when tested as a composite material.
3. The maximum length of flexible ductwork shall be 7 feet. Ductwork shall be extended to full length whenever possible without severe bends or kinks. Bends shall be made to maintain R/W equal to 1.5.
4. Black polymer film supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
   a. Pressure Rating: 4 inches WG positive pressure and 1 inch negative pressure.
   b. Insulation shall be 1-1/2 inch thick fiberglass.
   c. Maximum Velocity: 4000 fpm.
   d. Temperature Range: -20 degrees F to 175 degrees F.

F. Ducts: Galvanized steel, unless otherwise indicated.

G. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

2.3 DUCTWORK FABRICATION

A. Shop fabricate ductwork in 4-, 8-, 10-, or 12-foot lengths, unless otherwise indicated or required, to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA HVAC Duct Construction Standards, latest edition.

C. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with enter-line radius equal to 1.5 times associated duct width and fabricate to include turning vanes in elbows where shorter radius in necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division- 23 section “DUCT ACCESSORIES” for accessory requirements.

E. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

F. Round ductwork shall be spiral lockseam, 26 gauge minimum. Round ductwork exposed within occupied spaces shall be spiral lockseam, 20 gauge minimum.

G. Ductwork exposed within occupied spaces shall be internally sealed to provide a clean exterior appearance.

H. T's, bends, and elbows: Construct according to SMACNA (DCS).

I. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

J. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

K. Fittings shall be spot welded and internally sealed.

L. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard.

M. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

N. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.4 MISCELLANEOUS DUCTWORK MATERIALS

A. Provide miscellaneous materials and products of types and sizes indicated, and where not otherwise indicated, provide requirements as listed in the latest SMACNA manuals, including proper connection of ductwork and equipment.

B. Fittings: Unless otherwise shown on Drawings, following fittings shall be used: two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 8 inches; five-piece, 90-degree elbows for sizes over 8 inches; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.

C. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

D. Duct Joints: Joint and seal prefabricated, factory-build ducts, fittings, and couplings in strict accordance with duct manufacturer’s instructions. Install duct sealers, pop rivets or sheet metal screws and canvas and Arabol on each joint. Duct sealer shall be fire retardant. Sheet metal screw for joints shall be minimum #10 size galvanized.

E. Duct Access: Provide access panel sections in prefabricated, factory-build ducts for access to fire dampers, control equipment, etc. as specified in Duct Accessories Section. Access panel size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access panels. Minimum size access panels shall be 6 inches by 6 inches.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes indicated are outside dimensions. For lined ducts, duct sizes have been increased to account for lining.

E. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

F. Assemble and install ductwork in accordance with recognized industry practices, which will achieve air tight (leakage class 12 for 2-inch pressure class) and noiseless (no objectionable

noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8- inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type, which will hold ducts true to shape and to prevent buckling.

G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus- insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1.2 inches.

H. Support ductwork in manner complying with SMACNA “HVAC Duct Construction Standards.” latest edition, hangers and supports sections. Where special hanging of duct work is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.

I. Seal ductwork after installation to seal class required and method prescribed in SMACNA “HVAC Leakage Test Manual”, latest edition.

J. Indoor Applications: Seal all standing seams and transverse joints in all sheetmetal ductwork with Hardcast "Iron Grip" premium flexible water based duct sealant.

K. Outdoor Applications: Seal all standing seams and transverse joints in all sheetmetal ductwork with Hardcast Model Duct Seal 321 premium flexible water based duct sealant with UV inhibitors.

L. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

M. Use double nuts and lock washers on threaded rod supports.

N. Connect diffusers boots to low pressure ducts directly or with 7 feet maximum length of flexible duct held in place with strap or clamp.

O. Connect flexible ducts to metal ducts with Panduit style draw bands. Use one draw band in the inner liner and a second draw band over the outer vapor barrier jacket.

P. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 CLEANING AND PROTECTION

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances, which might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Temporary Closure: At ends of ducts, which are not connected to equipment or air distribution devices as time of ductwork installation, provide temporary closure of polyethylene film or other covering, which will prevent entrance of dust and debris until time connections are to be completed.

3.3 CLEANING UP

A. Upon completion of work remove materials, equipment, apparatus, and tools, and leave premises clean, neat, and orderly.

3.4 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply (System with Cooling Coils): Galvanized steel.
   2. Return and Relief: Galvanized steel.
   3. General Exhaust: Galvanized steel.

B. Ductwork Pressure Class:
   1. Supply, Return: 2 inch.
   2. Outside Air: 2 inch.
   3. Exhaust: 2 inch.

END OF SECTION

# SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices.

B. Backdraft dampers.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Flexible duct connections.

G. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. NFPA 92 - Standard for Smoke Control Systems; 2015.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

E. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, and hardware used. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Provide instructions for combination fire and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors and test holes.

1.6 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES

A. Manufacturers:

1. ProRail, Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Airsan Corporation
4. Anemostat Products Division, Dynamics Corporation of America
5. Environmental Elements Corporation, Subs. Koppers Company, Inc.

B. Manufactured turning vanes with 2" single thickness curved blades set at 1-1/2" on-center mounted in 2" vane rails, self-aligning, hot dipped galvanized steel.

C. Turning vanes, vane rails and mounting shall be constructed and installed in accordance with the SMACNA "HVAC Duct Construction Standards".

2.2 BACKDRAFT DAMPERS

A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. Ruskin Company; _____: www.ruskin.com.
2. Ruskin Manufacturing; Model FSD60FA or FSD60G (actuator accessible from rear) for sidewall grille application.
3. Ruskin Manufacturing; Model FSD36C for ceiling application.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

E. Operators: UL listed and labelled oil immersed with spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft. Provide circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper.

F. All actuators for combination fire and smoke dampers or smoke dampers shall be rated for continuous "On" duty and shall have a cycle time requirement of no more frequently than every six months.

2.4 DUCT ACCESS DOORS

A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.5 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.6 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections (Indoors): Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   a. Net Fabric Width: Approximately 8__ inches wide.
2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

C. Flexible Duct Connections (Outdoors): Fabric crimped into metal edging strip.
1. Fabric: Ventfabrics Ventlon UL listed fire-retardant duPont's Hypalon coated woven glass fiber fabric to NFPA 90A, minimum density 26 oz per sq yd, sunlight, ozone and weather resistant.
   a. Net Fabric Width: Approximately 6 inches wide.
2. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.7 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers for Round Ductwork and Rectangular Ductwork up to 10 inches in Height: 16 gauge steel minimum.

C. Multi-Blade Damper for Rectangular Ductwork: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware; Model CD35 Manufactured by Ruskin. Provide Ruskin Model CD50 for installation in medium pressure ductwork and/or ducts with velocities exceeding 1500 FPM.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings, Ventlok Model 607. On multiple blade dampers, provide oil impregnated nylon or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before filters, before coils, at fans where not supplied with equipment access doors, at automatic dampers, at fire dampers, at combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 24 x 30 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install combination smoke and fire dampers in accordance with NFPA 92A.

G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

# SECTION 23 34 23 - POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

C. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.3 REFERENCE STANDARDS

A. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; http://www.amca.org/certified/search/company.aspx.

B. AMCA 99 - Standards Handbook; 2010.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

H. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect units from physical damage by storing indoors or off site until roof mounting curbs or other mountings are in place, ready for immediate installation of units.

1.7 WARRANTY

A. See Section 01 77 00 - Closeout, for additional warranty requirements.

B. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

1.8 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

1.9 EXTRA MATERIALS

A. Supply two sets of belts for each fan.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

C. Carnes.

D. PennBarry: www.pennbarry.com.

E. or approved equal.

2.2 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.3 ROOF EXHAUSTERS

A. Product Requirements:

1. Performance Ratings: Conform to AMCA 210.
2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
3. Fabrication: Conform to AMCA 99.
4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof exhaust fans shall be centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.

D. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.

E. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing.

F. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

G. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.

H. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

I. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

J. Fans shall be Model CUE as manufactured by Greenheck or equal.

K. Roof Curb: 14 inch highself-flashing of galvanized steel with continuously welded seams, built-in cant strips.

L. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

M. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

N. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Provide sheaves required for final air balance.

E. Install backdraft dampers on inlet to roof exhausters.

END OF SECTION

# SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.2 RELATED REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.3 REFERENCE STANDARDS

A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council; 1984.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carnes Company HVAC: www.carnes.com.

B. Krueger: www.krueger-hvac.com.

C. Price Industries: www.price-hvac.com.

D. Titus: www.titus-hvac.com.

E. Nailor.

F. Tuttle & Bailey.

G. _____.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, adjustable pattern, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.

B. Frame: Channel lay-in frame for suspended grid ceilings.

C. Frame: Surface mount. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel off-white finish.

2.3 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish .

2.4 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch eggcrate louvers.

B. Fabrication: Aluminum with factory off-white enamel finish.

C. Frame: Channel lay-in frame for suspended grid ceilings.

2.5 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel finish .

2.6 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions with factory off-white enamel finish.

2.7 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory off-white enamel finish .

2.8 WALL GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 by 1/2 by 1/2 inch louvers.

B. Fabrication: Aluminum with factory off-white enamel finish.

C. Frame: 1-1/4 inch margin with countersunk screw mounting.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

END OF SECTION

# SECTION 23 40 00 - HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable, extended area panel filters.

B. Disposable panel filters.

1.2 RELATED REQUIREMENTS

A. A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section. Section 01 50 00 - Temporary Facilities and Controls: Filters for temporary heating and ventilating.

1.3 REFERENCE STANDARDS

A. AHRI 850 (I-P) - Standard for Performance Rating of Commercial and Industrial Air Filter Equipment; 2013.

B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

C. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to 1 Section 7.4.
   1. Dust Spot Efficiency: Plus or minus 5 percent.

1.5 SUBMITTALS

A. A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Filters: One set of each type and size.

PART 2 PRODUCTS

2.1 FILTER MANUFACTURERS

A. American Filtration Inc: www.americanfiltration.com.

B. AAF International/American Air Filter: www.aafintl.com.

C. The Camfil Group: www.camfilfarr.com.

2.2 DISPOSABLE, EXTENDED AREA PANEL FILTERS

A. Media: UL 900 Class 1, pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid by corrugated aluminum separators.
   1. Frame: Non-flammable.
   2. Nominal thickness: 1 inch.

B. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE Std 52.2.

C. Rating, per ASHRAE Std 52.2:
   1. Weight arrestance: 85 percent.
   2. Initial resistance at 500 FPM face velocity: 0.20 inch WG.
   3. Recommended final resistance: 0.9 inch WG.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

END OF SECTION

# SECTION 23 74 15 - PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged rooftop unit.

B. Unit controls.

C. Roof mounting curb and base.

1.2 RELATED SECTIONS

A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

B. Section 23 40 00 - HVAC Air Cleaning Devices.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Control components, time clocks.

D. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Installation of thermostats and other controls components.

E. Division 16 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute; 2005.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute; 1995.

C. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems; National Fire Protection Association; 2002.

D. Unit shall be designed to conform to ASHRAE 15, latest revision, and in accordance with UL 1995.

E. Units shall be UL tested and certified in accordance with ANSI Z21.47 Standard. Units may be ETL listed.

F. New roof curbs shall be designed to conform to NRCA Standards.

G. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Provide construction details, motor horsepower, brake horsepower and filter (size, capacity and efficiency). Submit complete fan performance charts and curves marked to indicate anticipated operating points for intended application.Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.7 WARRANTY

A. See Section 01 78 36 - Warranties, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

C. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

D. Provide five year limited warranty for heat exchanger including materials only.

1.8 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide one set of new filters at the completion of construction and one set of extra filters.

C. Furnish one complete set of fan motor drive belts.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Packaged Air Conditioning Units (3 to 12-1/2 Tons)
   1. Johnson Controls/York.
   2. The Carrier Corporation.
   3. Basis of Design: The Trane Company.
   4. or approved equal.

B. Substitutions: [10 working days prior approval required] as indicated under the general and/or supplemental conditions of these specifications. Mechanical contractor shall be responsible for electrical and mechanical changes to the structure when using a product other than the specified product. As built drawing changes are the responsibility of the mechanical contractor.

C. Manufacturer shall provide at a minimum:
   1. Manufacturer shall maintain a minimum of (8) factory direct service technicians within a 75 mile radius from the jobsite to ensure timely on-site assistance.
   2. Manufacturer shall maintain a parts store within a 75 mile radius to ensure availability of replacement parts and minimize equipment downtime.
   3. Manufacturer shall provide a factory direct service agency with 24 hour Emergency Support.
   4. Manufacturer shall provide local factory direct representative for engineering, installation, controls and design support.
   5. Equipment shall be supplied directly by manufacturer. Manufacturer dealer and/or representatives will not be acceptable
   6. Equipment startup up shall be performed by a factory direct service technician.
   7. Equipment shall have factory 1 year parts and labor warranty.

2.2 PACKAGED ROOFTOP AIR CONDITIONING UNITS (3-10 TON)

A. GENERAL UNIT DESCRIPTION
   1. Units furnished and installed shall be gas/electric packaged rooftops as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on ARI Standard 210. Units shall consist of insulated weather-tight casing with

compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls and drives.

2. Units shall be 100% factory run tested and fully charged with refrigerant.
3. Units shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
4. Units shall be convertible airflow design as manufactured.
5. Units shall operate between 0 deg F and 115 deg F.

B. UNIT CASING

1. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge.
2. Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
3. Cabinet construction shall allow for all service/ maintenance from one side of the unit.
4. Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.
5. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.
6. Units base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
7. Insulation: Provide 1/2 inch thick fiberglass insulation with foil face on all exposed vertical panels and top covers in the indoor air sections. The insulation shall be fire-retardent and odorless. All edges must be captured so that there is no insulation exposed in the air stream. The base of the unit shall be insulated with 1/2 inch, 1 pound density foil faced, closed-cell material.
8. Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.
9. The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

C. AIR FILTERS

1. Factory installed 2 inch 30% efficiency throwaway filters.

D. FANS AND MOTORS

1. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.
2. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
3. Provide units 5 tons and below with direct drive, multiple speed, dynamically balanced supply fans. Provide oversized motors where necessary to meet scheduled external static pressures.
4. Provide units 6 tons and above with belt driven, supply fans with adjustable motor sheaves and an adjustment idler-arm assembly for quick adjustment to fan belts and motor sheaves. Provide oversized motors where necessary to meet scheduled external static pressures.
5. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.
6. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
7. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

E. GAS FIRED HEATING SECTION

1. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant

cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping through the side of the unit.

2. Heating section shall be factory run tested prior to shipment.
3. Induced draft combustion type with direct spark ignition system.
4. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.
5. Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.
6. Heat Exchanger: Provide tubular section type constructed from 18-gauge aluminized steel.
7. Burners: Burners shall be of the in-shot type constructed of stainless steel.
8. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

F. EVAPORATOR AND CONDENSER COILS
1. Provide 5/16” copper tubes, mechanically bonded to configured aluminum plate fins.
2. Factory pressure test each circuit at 450 psig and leak test at 200 psig.
3. Provide standard IAQ sensitive removable, reversible, cleanable, double sloped drain pan for base of evaporator coil constructed of stainless steel.

G. COMPRESSORS
1. Compressor(s): Provide direct drive scroll compressors operating at 3600 rpm with centrifugal type oil pumps. Motors shall be suction gas cooled and have a voltage utilization range of +/- 10% of unit nameplate voltage.
2. Crankcase Heaters shall be factory installed.

H. REFRIGERANT CIRCUITS
1. Provide each refrigerant circuit completely piped with liquid line filter-drier, suction and liquid line pressure ports.
2. Provide factory installed thermal expansion valve (TXV) for each refrigerant circuit.

I. ECONOMIZER WITH BAROMETRIC RELIEF
1. Provide a fully integrated factory-installed 100% modulating outside air economizer with unit return and barometric relief air dampers, minimum position setting, preset linkage, wiring harness with plug, and fixed drybulb control. The factory installed economizer arrives in the shipping position and shall be moved to the operating position by the installing contractor.
2. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.
3. Provide direct acting direct drive actuators as specified in Section 23 09 33,
4. Where indicated on plans provide centrifugal blower power exhaust per “Modulating and Power Exhaust Economizer” specification requirements.

J. UNIT CONTROLS AND POWER REQUIREMENTS
1. Unit manufacturer shall provide microprocessor controls as standard that provide the following features and diagnostics preprogrammed and installed at the factory:
   a. Have built in anti-short cycle timer, time delay relay, and minimum on time controls.
   b. Have Adaptive Control that will allow the unit to continue to operate at predetermined temperature set points if a component goes astray.
2. Provide unit with single-point power entry.
3. BACnet Communications: The BACnet communications interface allows the unit to communicate directly with a generic open protocol BACnet MS/TP Network Building Automation System Controls.

K. ROOF CURB
1. Units shall be supplied with Micrometl 31 inch tall spring isolated, structurally calculated roof curb with hold down brackets, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Curb shall be shipped knocked

down and provided with instructions for easy assembly. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.3 STARTING EQUIPMENT AND SYSTEMS

A. Provide factory start-up and supervise installation by Contractor.

B. Manufacturer shall furnish a factory trained service engineer without additional charge to start the unit(s). Package rooftop unitary manufacturers shall maintain service capabilities no more than 100 miles from the jobsite.

END OF SECTION

# SECTION 23 81 43 - SPLIT-SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

B. Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 WORK INCLUDED

A. Installation of split system heat pumps as required for project .

B. MANUFACTURER: Subject to compliance with requirements, provide split system heat pumps of one of the following:
   1. Carrier
   2. Bryant
   3. Trane

1.3 QUALITY ASSURANCE

A. FLAME-SMOKE RATINGS: Except as otherwise indicated, provide thermal insulation with flame-spread index of 25 or less, fuel- contributed index of 50 or less, and smoke-developed index of 50 or less.

B. AMCA STANDARDS: Comply with Air Movement and Control Association (AMCA) Standards as applicable to testing and rating fans.

C. SMACNA COMPLIANCE: Comply with Sheet metal and Air-Conditioning Contractors National Association (SMACNA) ductwork construction standards as applicable to split system heat pumps.

D. U.L. COMPLIANCE: Provide electric components for split system heat pumps, which have been listed and labeled by Underwriters Laboratories or by a testing organization of equal standing.

1.4 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer's specifications for split system heat pumps showing dimensions, weight, capacities, ratings, certified fan performance with operating point clearly indicated, motor electrical characteristics, gauges and finishes of materials, and installation instructions.

B. MAINTENANCE DATA: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals only.

PART 2 - MATERIALS

2.1 SPLIT-SYSTEM HEAT PUMPS

A. GENERAL: Furnish and install split-system air to air heat pump systems, complete with automatic controls. The units shall be a standard product of a firm regularly engaged in the manufacture of heating/cooling equipment. The equipment shall be shipped completely factory assembled and precharged, with factory-recharged refrigerant piping, piped and wired internally ready for field connections. Provide thermal overload protected motors.
   1. All wiring shall be in compliance with CEC.

B. HEATING/COOLING SYSTEM: The total certified heating/cooling capacity shall not be less than scheduled. The compressor power input shall not exceed that of the unit specified.

C. The coils shall be non-ferrous construction with aluminum fins mechanically bonded to durable copper tubes. Coils shall be pressure-leak tested.
   1. The compressor shall be resiliently mounted, have built-in crankshaft lubrication, crankcase heater, discharge temperature limited, and current- and temperature- sensing motor overloads.

2.2 THE SYSTEM SHALL BE PROTECTED BY HIGH AND LOW PRESSURE SWITCHES AND A FIVE-MINUTE COMPRESSOR TIMED OFF CYCLE CONTROLLER (ANTI-RECYCLE TIMER).

A. CABINET: Galvanized steel with a baked-on outdoor enamel paint finish. Cabinet panels where conditioned air is handled shall be fully insulated. Lifting lugs shall be provided for rigging of condenser.

B. SERVICE ACCESS: All components, wiring, and inspection areas shall be completely accessible through removable panels.

C. SUPPLY AIR BLOWERS: Centrifugal blowers shall have direct-drive motors. The entire assembly shall be resiliently rubber mounted. Blower wheel shall be statically and dynamically balanced. Unit shall have automatic louvers to adjust airflow for heating and cooling.

D. CONDENSER FANS: Propeller-type condenser fans shall discharge horizontally. Fan motor shall be totally enclosed with sleeve bearings, permanently lubricated, inherently protected. Fan shall be protected by a steel guard.

E. Air Filters: Provide 2-inch thick non-pleated fiberglass throwaway filters with cardboard holding frames for indoor unit. Provide sufficient filters for four complete changes for each unit.

F. Units shall be complete with heat strip as noted on Drawings.

G. Control system shall be microprocessor based with a controller for each unit. Controller shall provide for remote adjustment of louver position, fan speed adjustment, temperature adjustment, and test mode.

2.3 CONDENSATE DRAIN

A. Provide type L hard drawn copper tubing with wrought copper solder joint fittings; no iron to copper connections; copper fittings with IPS outlets and threaded brass nipples at connections to fixtures and equipment; di-electric couplings or unions at connections to dissimilar materials. Supply piping with temporary caps on all piping.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which heat pump units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HEAT PUMP UNITS

A. Install heat pump units where indicated, in accordance with equipment manufacturer’s written instructions and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

3.3 TESTING

A. Upon completion of installation of heat pump units, start up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

END OF SECTION

# SECTION 26 00 00 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Furnish and install all necessary labor, materials, tools and equipment to perform and completely finish the work according to the intent of this specification, and the accompanying drawings.

B. Furnish and install any incidental work which can reasonably be inferred as required and necessary to provide complete and workable systems.

C. Provide connections of all equipment specified under these sections and other Divisions including Divisions 22 (Plumbing) and 23 (HVAC) including installation and connection of all motors, relays, remote starters, etc.

D. The requirements of the General and Supplemental Conditions, and Division 01 apply to Divisions 26, 27 and 28, and these specifications. All sections in Divisions 26, 27, and 28 are interrelated. Work specified in other sections, as applicable, shall apply to all work hereunder.

1.2 LOCAL CONDITIONS

A. Examine site; verify dimensions and locations against drawings and become informed of all conditions under which work is to be done before submitting proposal. No allowance will be made for extra expenses because of omission on Contractor's part to include cost of work under prevailing conditions.

B. Information shown relative to services is based upon available records and data shall be regarded as approximate only. Minor deviations found necessary to conform with actual locations and conditions shall be made without extra cost.

C. Extreme care shall be exercised in excavating near existing utilities to avoid any damage thereto. It shall be the contractor's responsibility to verify existing underground utilities prior to digging anywhere. Information provided on these plans indicating existing conditions shall only be used as reference, and shall not be deemed considered accurate. Any damage to existing utilities done by the contractor shall be repaired and/or replaced by the contractor at their expense to its pre-damage condition.

1.3 PERMITS AND INSPECTIONS

A. Obtain and pay for all permits and service charges required in installation of the work. Arrange for required inspections and secure approvals from authorities having jurisdiction.

B. During its progress, work shall be subject to inspection by Project Inspector.

1.4 CODES AND STANDARDS

A. Work and materials shall be in full accordance with California Occupational Safety Health Act (CAL-OSHA), California Electrical Code (CEC), State Fire Marshal, Electrical Safety Orders (Title 8, Subchapter 5), the National Fire Protection Association, California Building Code (CBC); California Code of Regulations - Title 24 and other applicable State or local laws or regulations. Nothing in the Drawings or Specifications shall be construed to permit work not conforming to these codes.

B. Electrical materials shall bear the label of, or be listed by, the Underwriter's Laboratories (UL) unless of a type for which label or listing service is not provided.

C. Materials and components shall conform to Industry Standards, including:

| | | |
|---|---|---|
| NEMA | - | National Electrical Manufacturer's Association |
| ANSI | - | American National Standards Institute |
| ASTM | - | American Society For Testing Material Association |
| IPCEA | - | Insulated Power Cable Engineer's Association |
| CBM | - | Certified Ballast Manufacturers |

D. When Contract Documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge.

1.5 REVIEW OF MATERIALS

A. Prior to commencement of Work and within 35 days after award of contract, submit for approval in accordance with General Conditions all equipment and materials to be furnished.

1. Equipment/Product submittals shall be bound and indexed and shall include a table of contents listing all equipment submitted. The table of contents shall include: Project designation, submittal number, submittal name including specification section, date, and include manufacturer, model number, reference specification paragraph or sheet detail number, description, and page location. Where a group or series of products are submitted, each item do not have to be listed, only the series need to be identified. Example:

**Project:**
**Submittal No.**
**Submittal Name:**
**Date:**

| **Page(s)** | **Manufacturer** | **Model No.** | **Detail No.** | **Spec para., Description** |
|---|---|---|---|---|
| **1-12** | **XYZ Corp** | **123ABC** | **2.05** | **Control pane** |
| **13,14** | **XYZ Corp** | **456DEF** | **2.06-A** | **Power supply** |
| **15** | **ABC Corp** | **789GHK** | **A/E9.5** | **Rack** |
| **16,17** | **Cantex** | **PVC-40** | **2.01** | **PVC conduit** |
| **18** | **Steel City** | **XYZ series** | **2.02** | **Steel fittings** |

2. Shop drawings submittals shall be neat and professionally done using CAD (computer aided drafting), hand-drawn submittals will not be accepted. Shop drawings shall have sufficient information to clearly indicate work to be performed and be complete including device/equipment locations, wire sizes, wire types and number of wires, symbol list or legend, point-to-point connections, wiring diagrams, and equipment anchorage detail where needed. Shop drawings shall utilize the same size paper as the Bid set of plans.

3. Electronic submittals in PDF format are allowed and preferred.

B. Substitutions:

1. Only one request for substitution will be considered on each item of material or equipment. No substitutions will be considered thereafter. Substitutions will be

interpreted to be all manufacturers other than those specifically listed by model or catalog number. Should the original submittal of a proposed substitution be rejected, the specified item shall be furnished.

2. Submit complete information or catalog data to show equality of equipment or material offered to that specified. Identify which product is being substituted in the specifications and/or the plans and provide analysis as indicating either it "Complies" or that it "Does Not Comply" and providing a reason. Each Specification paragraph shall be provided with this analysis. No substitutions will be allowed unless requested and approved in writing. Materials of equal merit and appearance, in the opinion of the Engineer, will be approved for use. Engineer reserves the right to require originally specified item.
3. Acceptance of a substitute is not to be considered a release from the Specifications. Any deficiencies in an item, even though approved, shall be corrected by the Contractor at his expense.
4. Responsibility for installation of approved substitution is included herein. Any changes required for installation of approved substituted equipment shall be made without additional cost to Owner.

C. Where it is in the best interest of the Owner, Engineer may give written consent to a submittal received after expiration of designated time limits, or for an additional resubmittal.

D. Submit for approval in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials covered in list mentioned above. Submit in accordance with General Conditions in a complete package; partial submittals will not be considered.

E. Failure to comply with any of the preceding requirements will necessitate that the specified materials be submitted and supplied.

1.6 RECORD DRAWINGS

A. Upon completion of Work, furnish Engineer with Autocad file, PDF file, and one printed full size hardcopy upon which shall be shown all Work installed under contract including any work which are not in accordance with Original Contract Drawings. Autocad files shall be 2004 or later version, with external references bound to its parent drawing. Provide a separate PDF file for each sheet, do not combine all sheets into a single file. Furnish digital files on a USB flash drive or CD.

1. The above shall also include shop drawings.

B. All symbols and designations used in preparing Record Drawing shall match those used in Contract Drawings.

C. Show all buried and concealed conduit, stub-outs, etc. Locate all buried conduit and stub-outs by dimensions from permanent, easily located and identifiable portions of structure; also, dimension ends of stub-outs, etc. Note depth of buried items below grade.

1.7 ADDENDA AND CHANGE ORDERS

A. Changes in the plans and specifications shall be made by Addenda or Change Orders signed by the Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials mentioned herein or on drawings require that each item listed be provided and of quality noted, or an approved equal. All material shall be new, full weight and standard in all respects and in first-class conditions. Where possible, all materials used shall be of the same brand or manufacturer throughout for each class of material or equipment.

B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein. Dimensions, sizes and capacities shown are a minimum and shall not be changed without permission of Engineer.

PART 3 EXECUTION

3.1 DRAWINGS AND COORDINATION

A. Examine Drawings and Site; be familiar with types of construction where electrical installation is involved. Work shall be neatly installed in a workmanlike manner in accordance with NECA Standard of Installation. Work shall be coordinated with other trades to avoid conflicts. Clarifications will be made by Engineer and minor adjustments shall be made without additional cost to Owner. Obtain ruling from Engineer concerning any obvious discrepancies or omissions in work before bidding. All work involved in correcting obvious errors or omissions after award of Contract shall be performed as directed by Engineer without additional cost to Owner.

B. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial), but shall be followed as closely as possible. Drawings and Specifications are for assistance and guidance, and exact locations, distances, levels, etc., will be governed by Site.

C. All equipment (devices, conduits, boxes, etc.) shall be flush or semi-flush mounted unless otherwise noted. Where conditions do not allow flush mounting and where acceptable to the Architect, equipment may be surface mounted.

3.2 WORKING SPACE

A. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders. In general, provide 36 inches minimum clear work space in front of panelboards and controls of 120/208 volt systems and 42 inches minimum for 277/480 volt systems.

3.3 CARE AND CLEANING

A. All broken, damaged or otherwise defective parts shall be repaired or replaced without additional cost to Owner. Work shall be left in a condition satisfactory to Engineer. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work. Systems and equipment shall be left in a satisfactory operating condition.

B. All surplus materials and debris resulting from this work shall be cleaned out and removed from site; this includes surplus excavated material.

3.4 EXCAVATING AND BACKFILLING

A. Excavate and backfill as required for installation of electrical work. Restore all surfaces, roadways, sod, walks, curbs, walls, existing underground installation, etc., cut by installations to original condition in an acceptable manner. Maintain all warning signs, barricades, flares

and lanterns as required by the Safety Orders and local ordinances.

B. Excavation: Dig trenches straight and true to line and grade, with bottom clear of any rock points. Minimum conduit depth of pipe crown shall be 24 inches below finished grade.

C. Backfill: Support conduits with 2" sand bedding at bottom of trench. Provide sand backfill from bottom to 12" below finished grade. The top 12" to be local fine earth material free of rubble, rubbish or vegetation. Trenches shall be backfilled and compacted to 90% (per ASTM D1557) of maximum dry density at optimum moisture content in layers not to exceed 6" when compacted.

3.5 PROTECTION

A. In performance of work, protect work from damage. Protect electrical equipment, stored and installed, from dust, water or other damage.

3.6 EQUIPMENT IDENTIFICATION

A. Panelboards, remote control switches, terminal boxes, etc., shall be properly identified with a descriptive nameplate. Nameplate shall be made of 3/32 inch laminated plastic with black background and white letters. Size of letters shall be 1/4 inch high for equipment in device box or boxes 12" or smaller, and 1/2 inch high for panelboard, terminal can, or larger items. Letters shall be machine engraved. Punched strip type nameplates and cardholders in any form are not acceptable. Nameplates shall be attached with oval head machine screws tapped into front panel.

B. Indicate type of equipment and equipment designation, ex. "PANEL-XXX", "MAIN SWITCHBOARD-XXX", "TRANSFORMER-XXX", "SIGNAL-XXX", "TV-XXX", "EF-1", "AC-1", etc.

3.7 RUST INHIBITOR

A. Channels, joiners, hangers, straps, clamps, brackets, caps, nuts and bolts and associated parts shall be plated electrolytically with zinc followed immediately thereafter by treating freshly deposited zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of one hundred twenty (120) hours when subjected to a standard salt spray cabinet test, or shall be hot dipped galvanized.

3.8 EQUIPMENT PADS

A. Concrete reinforced pads for mounting of equipment (i.e. switchboard, transformers, freestanding panels, etc.) shall be minimum 3000psi, 6" thick with #4 rebars at 12" on center each way. Rebars shall be centered in pad. Pad shall extend 2" beyond equipment and 1.5" above surrounding area. Backfill and compact to 95% maximum dry density at optimum moisture content in layers not to exceed 6" when compacted.

3.9 EQUIPMENT ANCHORAGE

A. Seismic Anchorage of Electrical equipment shall conform to the regulations of 2010 CBC (California Building Code) and ASCE 7-05, sections 13.3, 13.4, and 13.6. All equipment shall be braced or anchored to resist a horizontal force acting in any direction using the following criteria:

1. The total design lateral seismic force shall be determined from section 1614A of 2010

CBC and 13.3 ASCE 7-05. Forces shall be applied in the horizontal directions which results in the most critical loading for design.

2. The value if Ap (component Amplification factor) and Rp (component response modification factor) of section 13.3.1 ASCE 7-05 shall be selected from section 13.6-1 ASCE 7-05. The value of Ip (seismic importance factor) shall be selected from 13.1.3 ASCE 7-05.

B. Where anchorage details are not shown on the drawings, the field installation shall be subject to the approval of the structural engineer and the field representative of the Office Of The State Architect.

3.10 ARC FLASH

A. Electrical equipment such as switchboards, panelboards, load centers, motor control centers, industrial control panels, meter centers shall be field marked to warn persons of potential electric arc flash hazards per CEC 110.16 and NFPA 70E Standard for Electrical Safety in the Workplace. Minimum label wording shall be as follows:

DANGER
Arc Flash and Shock Hazard.
Appropriate PPE Required.
Do not operate controls or open doors without appropriate
personal protection equipment.
Failure to comply may result in injury or death.

3.11 TEST

A. Test all wiring and connections for continuity and grounds; where such test indicate faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.

3.12 CLOSING OF AN UNINSPECTED WORK

A. Do not allow or cause any of work installed hereunder to be covered up or enclosed before it has been inspected and approved.

B. Should any work be enclosed or covered up before it has been approved, uncover such work and after it has been inspected and approved, make all repairs necessary to restore work of others to conditions in which it was found at time of cutting, all without additional cost to Owner.

3.13 WARRANTY

A. All materials and installation shall be provided with a minimum of one (1) year warranty which shall include replacement parts, labor, retesting, and travel to and from the job site. The warranty period shall begin after final acceptance of the project. The warranty shall cover but is not limited to the following:

1. Defective workmanship and installation.
2. All System components, devices, conduit, wires, etc.

3. Manufactured items such as light fixtures, receptacles, switchboard, panelboard, transformer, switches, etc.
4. Basic materials such as conduit, wires, boxes, cabinets, etc.

B. Certain manufactured items will have longer warranty periods. Refer to specific item and specification section for warranty information and terms.

## END OF SECTION 26 00 00

# SECTION 26 05 00 - BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.1 SCOPE

A. The work of this Section consists of basic materials and methods for all work included under Divisions 26, 27, and 28. Additional specifications requirements for electrical work are specified under other sections of Divisions 26, 27 and 28 and where those requirements differ from the requirements of this Section, they shall govern.

1.2 SUBMITTALS

A. Submit product data per Section 26 00 00.

PART 2 PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Standard weight, mild steel pipe, zinc coated on both inside and outside by a hot dipping or sherardizing process. Inside and outside of conduit shall be finished with a protective coating. All threads galvanized after cutting. Meets UL 6, UL Card #DYIX, and ANSI C80.1.

B. Electrical Metallic Tubing (EMT): Cold rolled steel tubing, hot-dipped galvanized, with zinc coating on outside and protective lubricating coating on inside. Fittings shall meet same requirements for finish and material as EMT. Meets UL 797 and ANSI C80.3.

C. Flexible Conduit: UL Listed. Flexible steel, coated on both inside and outside by hot dipping or sherardizing process. Liquid-tight conduit shall be galvanized with extruded polyvinyl covering and with watertight connectors, sunlight resistant, direct burial rated. Flexible steel conduit less than 1/2" shall not be used except that 3/8" shall be permitted in lengths not in excess of 6 feet as part of a listed assembly or for tap connections to lighting fixtures as required in CEC Section 410-67(c). Flexible conduit to be one continuous length, no couplings. AFC Liquid-Tuff Type-LFMC and AFC Reduced Wall Flexible Steel Conduit, or equal.

D. PVC Conduit:

1. Type 40, 90°C, UL listed, composed of polyvinyl chloride, conforming to NEMA TC-2, Fed Spec WC1094A, UL651 Standards. Material shall have minimum tensile strength of 6,500 psi at 73.4°F, flexural strength of 12,500 psi and compressive strength of 9,000 psi per ASTM testing. PVC conduit shall be suitable for direct burial without concrete encasement. Fittings shall be of same manufacture. All joints shall be solvent welded.

2. Type 80, similar to type 40 except with extra heavy wall.

3. Only manufactured elbows/bends shall be used. Where field bends have to be made, obtain prior approval by the engineer.

E. Raceway Fittings:

1. Rigid Steel Conduit: Fittings, such as couplings, connectors, condulets, elbows, bends,

etc., shall be subject to same requirements as for rigid steel conduit. Couplings and unions shall be malleable iron, threaded type, assembled with anti-corrosion, conductive anti-seize compound at joints made absolutely tight to exclude water. Connectors shall be threaded hubs with bonding insulated metallic bushings. Unions shall be equal to Crouse Hinds UNY or UNF.

2. EMT: Fittings shall be steel, box connectors shall have insulated throat. Connectors and couplings to be compression type.

3. Flexible Metallic Conduit: Connectors to be insulated. Metallic connectors (except for liquid-tight) shall compression type. Liquid-tight metallic connectors shall be watertight approved for such use.

4. Bushings: Metallic insulated type. Weatherproof or dust-tight installations; liquid-tight with sealing ring and insulated throat, OZ/Gedney type "KR".

5. Expansion and Deflection Fittings: OZ/Gedney, Type "DX" or accepted equal.

6. All box connectors to be insulated throat type.

7. Conduit Straps: Galvanized steel, 2-hole straps. 1-hole straps may be used for conduit sizes 1" and smaller concealed in wall or above ceiling.

8. PVC Conduit: Fittings shall be same grade of material as conduit, solvent welded to conduit.

F. Metallic conduits, raceways, and fittings shall be listed and approved as a grounding means.

2.2 BOXES

A. Galvanized one-piece or welded pressed steel type. Boxes for fixture shall not be less than 4" square and shall be equipped with fixture stud. Boxes shall be at least 1-1/2" deep, 4" square for 1 or 2 gang devices, with plaster rings and gang box with gang cover. Boxes mounted in wall or ceiling finished with gypsum board shall be furnished with 3/4" deep plaster rings. Use screws and not nails to support/secure outlet boxes. Provide blank cover plates for all boxes without devices.

1. 1-gang and 2-gang outlet and junction boxes installed exposed outdoors shall be weatherproof malleable iron boxes, Appleton or equal. Plug all unused hubs.

2. Provide 1#12 equipment grounding pigtail at all outlet boxes.

3. Outlet boxes for data, telecommunications, video, and TV outlets shall be 4 11/16" square x 2.125" deep.

4. Outlet boxes containing #8, #6, or #4 AWG wires shall be a minimum 2.125" deep per CEC.

B. Junction boxes located outdoors, or in wet or damp locations shall be rated NEMA-3R, with while-in-use hinged metal door and pad-locking tabs.

C. Floor boxes shall be one-gang or multi-gang recessed, fully adjustable with brass lids, cover

plates, rings, flanges, etc. for respective tile or carpet floor finish, meet UL514A & UL514C scrub water exclusion requirements for tile and carpet floors. For carpet floors, provide with carpet flange. For "hard" floors such as tile or wood, the top of the cover shall be flush with the top of the finished floor. Receptacle covers shall have individual flip-lids with screw lock. Junction boxes shall have screwed on plugs.

1. Grade level or below: Watertight and concrete-tight of cast iron construction, Walker 880CS series or equal.

2. Above grade level: Concrete-tight of stamped steel construction, Walker 880S series or equal.

3. Raised wood floors: Steel box, Walker 880W series or equal.

D. Poke-through devices shall be recessed, with brass lides, cover plates, rings, flanges, etc. for respective tile or carpet floor finish, meet UL514A & UL514C scrub water exclusion requirements for tile and carpet floors. For carpet floors, provide with carpet flange. For “hard” floors such as tile or wood, the top of the cover shall be flush with the top of the finished floor.

1. Poke-Thru Assembly:

   This assembly consists of an insert and an activation cover. Overall poke-thru assembly length shall be 16 3/4” [425mm].

2. Insert:

   The insert body shall recess the devices a minimum of 2 3/4” [69mm] and have a polyester based backing enamel finished interior (ivory). There shall be the necessary channels to provide complete separation of power and communication services. There shall be three compartments that allow for up to three duplex receptacles that can be wired as a standard receptacle or isolated ground and/or twelve communication ports and/or ten of Extron® Electronics MAAP™ and/or two AAP™ devices.

   The body will consist of an intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain fire rating of the unit and the floor slab. The insert shall have retaining feature that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4” trade size conduit stub that is connected to the insert body and a 24.5 cu. in. [402ml] stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru device to the system ground.

3. Activation Cover:

   The activation covers shall be manufactured of die-cast aluminum alloy and be available in powder-coated gray, black, or plated in brass, nickel or bronze finish. Two gaskets (one for carpet and one for tile) are provided to go under the trim flange to maintain scrub water tightness. The activation cover shall be 7 1/4” [184mm] in diameter. The activation covers shall be available in carpet and tile versions. The carpet covers shall be surface mounted and the tile covers shall be flush with the finished floor covering. The cover shall have spring loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible.

4. Communication Modules Mounting Accessories:

   The activation shall have three locations to mount communication connectors. Connectors shall be mounted using a mounting bracket. Mounting brackets shall be provided to mount up to twelve Ortronics TracJack Category 6 insert modules or TechChoice™ Category 6 discrete keystone connectors. The unit will also be supplied with two Category 6 keystone connectors and two Lucent® keystones. The unit shall also accommodate a mechanism to permit protection of communication cabling. This mechanism shall be stamped steel construction and accept both flexible and rigid conduit. This mechanism shall accept 3/4", 1-1/4" or 2" trade size conduits.

5. Watertight and fire rated, Walker Evolution series 6AT or equal.

E. Equipment furnished by other trades but requiring electrical connection shall be provided with appropriate backbox.

2.3 WIRES

A. Wire shall be copper only, manufactured by General Cable Co., Rome, General Electric Co., or Anaconda. Wire shall be rated 90 degrees C for both dry and wet locations, THWN-2, XHHW-2, or RHW-2 insulation. 90 degrees C THHN may be used in dry and damp locations. Wire installed in high temperature areas, including branch circuits in or above roof insulation or in fluorescent ballast channel, shall have type RHW-2 or XHHW-2 90° insulation.

   1. Feeders sized #2 and larger routed below grade, extending beyond or outside the building foundation line shall use types XHHW-2, THW-2, or RHW-2 insulation, 90 degrees C dry and wet rated.

B. Wire shall be Code type copper wire of not less than 98% conductivity. Wires #8 gauge and larger, shall be stranded. Wires shall bear the Underwriters' label, be color coded and be marked with gauge, type and manufacturer's name on 24" centers. Wires smaller than #8 may be solid or stranded. Where stranded wire is used, provide solid pigtail for connection to screw terminals of receptacles, switches, etc.

C. Color coding to be as follows:

| | 208/120 Volts | 480/277 Volts |
|---|---|---|
| Phase A | Black | Brown |
| Phase B | Red | Orange |
| Phase C | Blue | Yellow |
| Neutral | White | Natural Grey |
| Ground | Green | Green |

   Switch legs shall use the same branch circuit phase color coding which they are connected to. IG ground wire shall be green with yellow tracer.

D. Bring wire to job in original unbroken packages. Obtain approval of inspector or Engineer before installation of wires.

2.4 WALL SWITCHES

A. Shall be "AC" rated, heavy duty, quiet type, rated 20 amperes at 277 volts A.C. Application of switches shall comply with CEC Section 380-8. Handles shall be bakelite; color shall be compatible with adjacent wall finish. Switches to be as follows:

| Manufacturer | Single Pole | 3-Way |
|---|---|---|
| A & H | 1991 | 1993 |
| Hubbell | 1221 | 1223 |
| P & S | 20AC1 | 20AC3 |
| Leviton | 1221 | 1223 |

B. Weatherproof light switches shall have lever switch covers of die cast construction with gasket and gray finish. Hinged flip-lids are not acceptable.

2.5 CONVENIENCE OUTLETS

A. Shall be "Specification" grade rated 15 amperes at 125 volts, duplex, composition base with slots to accommodate parallel plug caps with grounding peg. Contact shall grip both sides of plug prongs. Where only one receptacle is connected to a 20 ampere circuit, a 20 ampere receptacle shall be used. Outlet shall be UL listed. Receptacles to be Hubbell or equal.

1. 15 Amp: Hubbell 5262 series Heavy Duty Industrial Grade, 8200 series for Hospital Grade.

2. 20 Amp: Hubbell 5362 series Heavy Duty Industrial Grade, 8300 series for Hospital Grade.

3. Other designations as noted below:

a. Ground Fault: GFR
b. Tamper Resistant: TR
c. Weather Resistant: WR
d. Isolated Ground: IG

4. Leviton 5252, 5352, 8200, and 8300 series can be considered equal.

5. Pass & Seymour 5252, 5352, 8200, 8300 series can be considered equal.

B. Provide devices with matching plates. Isolated ground (IG) receptacles shall be orange with matching color plate. Hospital grade receptacles shall have a distinctive "green" dot. GFI receptacles shall have a visible (light) indicator. Receptacles and switches shall be terminated with “stakon” type fork on ring crimp terminal.

C. All 15 and 20 Amp, 125V and 250V non-locking receptacles (NEMA 5-15, 5-20, 6-15, 6-20) located outdoors and/or in damp or wet locations shall be listed weather-resistant type. Weather resistant receptacles shall be the same grade or class as 15A and 20A receptacles specified above.

D. Weatherproof covers for receptacles in wet locations shall be rated as weatherproof whether or not a plug is inserted (NEMA-3R), minimum 3.25" clearance from front of receptacle, metallic cast type with hinged lid and padlocking hasp, Leviton or equal. Weatherproof covers for receptacles in damp locations shall be rated as weatherproof when attachment plug is removed, with metallic cast cover and flip lids with padlocking hasp.

E. Provide a separate GFI duplex receptacle at each location identified on the drawings and as specified. Through wiring is not acceptable. Receptacles located at the following locations shall be GFI type, whether indicated in the plans or not.

1. In elevator control rooms.

2. In elevator pits/shafts.

3. In bathrooms or restrooms.

4. Outdoors, on the exterior of the building, and on/above the roof.

5. In commercial and institutional kitchens, unless dedicated to specific equipment.

6. Within 72" from any sink or basin such as in a small kitchen, lunch/break room, and the like.

2.6 PANELBOARDS

A. Panelboards shall meet NEMA AB-1, PB-1, PB1.1, PB1.2. Panelboards shall be type NQOD, NEHB, I-Line, Power-R-Line, A-Series, and CCB as specified for secondary utilization voltage and phase. As manufactured by Square-D, Cutler-Hammer/Eaton, General Electric, or approved equal. Square-D has been used for design purposes. Busses shall be copper. Provide with neutral buss and copper ground buss. Series rated equipment are not acceptable. Panels shall have full height fully rated bussing.

B. Circuit breakers shall be bolt-on type thermal magnetic, single-pole and multi-pole for branch circuit control with trip-rating permanently marked on the handle. Where trip-rating is not marked on the handle, provide engraved label adjacent to the breaker indicating amperage rating. Multi-pole breakers shall be common trip type with single handle. Factory assembled and listed multi-pole breakers with handle ties shall be acceptable. Bails will not be accepted except where used with multi-wire branch circuits through fluorescent lighting fixtures. All circuit breaker handles shall be equipped with padlocking tabs, "lock-off" device. All circuit breakers shall be fully rated to withstand the available short circuit current as designated on the drawings. Series rated equipment will not be acceptable.

   1. Circuit breakers 300 amps and higher shall be solid state type with field adjustable Long-Time and Instantaneous settings and field replaceable trip rating plugs.

C. Enclosures shall be code gauge, galvanized metal with front trim and hinged door with lock masterkeyed. Front trim shall be equipped with concealed trim clamps and concealed door hinges. Enclosures shall be rated NEMA-1 at dry indoor locations, and NEMA-3R where located outdoors in damp or wet locations. Lighting and appliance branch circuit Panelboards shall be maximum 20" wide and 6" deep. Panel trim and cabinet shall be finished ANSI-49 or ANSI-61 gray, except panel cabinets to be recessed are not required to be painted. Surface cabinets shall be without knockouts. Inside door shall have frame for circuit identification card. Fill out card, typewritten, with list of circuits corresponding with the circuit number. Identification shall be specific with room designation, type of load, etc, (i.e., "Classroom 214 receptacles"). For distribution panels, provide engraved laminated labels for load served where identification card is not provided.

D. Panelboard submissions shall include a ladder diagram, physical and electrical data, numbering and trip rating of each circuit breaker. Panelboard shall bear the UL label of approval.

E. Panelboard types as indicated on the drawings shall be the minimum size and type. Provide a larger size and type of panelboard as necessary for the breakers and features/accessories as indicated.

F. Circuit breaker arrangement shall be per the panel schedule.

G. Panel nameplate label shall identify panel, minimum AIC rating, and equipment it is fed from, example as follows, "PANEL-XXX, MAX. 22,000 AIC, FED FROM YYY". Where fed via a transformer, it shall read, "PANEL-XXX, MAX. 14,000 AIC, FED FROM YYY THRU TRANSF-ZZZ". Label shall be engraved plastic per section 26 00 00. 1/2 inch letters for panel identification.

2.7 SAFETY/DISCONNECT SWITCHES

A. Type "HD" Heavy Duty safety switches with externally operated handle. Switches shall be manufactured by Westinghouse, General Electric, Square D, or approved equal. Switches shall be rated 250 and 600 volts, A.C., of size and poles as shown on Drawings and as required. Disconnects used outdoor shall be in NEMA-3R. Provide fused switches with proper sized fuses where required by equipment manufacturer. All switches shall have pad-locking cover with interlocking cover. Switches shall be capable of be pad-lockable in the OFF position. Label switch with circuit identification per section 26 00 00, example "AC-1, HD1-24".

2.8 INDIVIDUAL CIRCUIT BREAKERS

A. Circuit breakers shall be molded case thermal magnetic type with trip rating as scheduled on drawings.

1. Circuit breaker trip settings 300 amps and higher shall be solid state type with field adjustable Long-Time and Instantaneous settings and field replaceable trip rating plugs.

2. Circuit breakers with trip settings 1200 amps and higher shall be solid state electronic type with full function trip units including: LTUP, LTD, STPU, STD, Inst PU, Inst OFF, GFPU, GFD.

B. Circuit breakers shall be quick-make, quick-break, trip free operation. The trip-free mechanism shall be independent of manual handle control. All circuit breakers shall be fully rated to withstand the available short circuit current as designated on the drawings. Series rated equipment will not be acceptable.

C. Breakers to be in NEMA-1 (indoor) or NEMA-3R (damp, wet, and outdoor) enclosures. NEMA-3R enclosures shall have the handle concealed behind the cover, and the hinged cover shall be provided with padlocking tabs. Each circuit breaker shall be identified with an engraved, laminated phenolic plate showing the load served or the function of the circuit breaker and trip rating. The nameplate shall be attached with oval head machine screws tapped into the front of the board. Equip breaker handles with padlocking "lock-off" devices.

2.9 PULL LINE

A. Furnish and install pull line in all unused (empty) raceways. Pull lines shall not rot or mildew.

1. Conduits up to 1.5": 1/8" diameter braided line of polypropylene with 200 lbs. tensile strength, IDEAL, Jet-Line #232, or equal.

2. Conduits 2" or larger: 3/16" polypropolene pull rope with 800 lbs. tensile strength, IDEAL Pro-Pull or equal.

B. Provide pull line in conduits for utility company systems, size and type per their requirements.

2.10 ACCESS DOORS

A. Milcor, Newman or equal with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, and style of door to suit ceiling or wall construction, including fire rating. Access doors in acoustical tile ceilings shall be Hi-Hatch with tile recess. Doors shall be 14 gage C.R. steel and shall be 22" x 30"; 24" x 24" in tile ceilings, unless otherwise noted or required.

2.11 PRECAST CONCRETE PULLBOXES/HANDHOLES

A. Boxes shall be size as indicated on the drawings. Design loads shall consist of live, dead, impact, hydrostatic, and other loads. Live loads shall be for H-20 and/or H-20-S16-44, or as required, per A.A.S.H.O. standard specifications for highway bridges with revisions. Design loads shall be sixteen KIPS. Concrete shall be per ASTM-C-33-64. Lightweight concrete shall conform to ASTM-C-33-64T. Cement shall be Portland Cement meeting ASTM-C-150 Type II standards. Compressive strength shall be minimum 4,000 psi at 28 days.

B. Larger Boxes (48" x 30" or larger): Precast high-density reinforced concrete with end and side knockouts, pulling-in irons. Minimum 4" wall thickness. Coordinate size of thinwall knockouts with manufacturer for conduit entry. Acceptable manufacturers shall be Forni, Christy or equal.

C. Smaller Boxes (smaller than 48" x 30"): Precast high-density reinforced concrete with end and side knockouts, and extension as required. Minimum 1.5" wall thickness. Acceptable manufacturers shall be Forni, Christy or equal.

D. Covers: Larger box covers, in other than concrete paving areas, shall be one or multi piece as required, steel checker plate, galvanized with anti-slip surface rated for parkway loading, with hold-down bolts. All other box covers shall be reinforce concrete with hold down bolts. Where susceptible to vehicular traffic, use H-20 rated traffic cover. All covers shall be factory marked, see drawings for marking/label required. If not noted, use the following markings:

| SYSTEM | MARKING |
|---|---|
| Power 600 volts or less | Electrical |
| Power over 600 volts | Danger High Voltage-Keep Out |
| Telephone | Telephone |
| Clock, Unified Signal, etc. | Signal |
| Fire Alarm | Fire Alarm |
| Television | T.V. |
| Lighting | Lighting |
| Grounding | Ground |

E. Installation:

1. Excavate around area to accept box, a minimum of 4" around all sides for ease of installation. Provide 12" of compacted pea gravel for bedding and/or to facilitate drainage.

2. Backfill shall consist sand or fine earth, compacted. Saturated soil or large rocks shall not be used. No voids shall remain between walls and native soil.

3. Grout and seal conduits at box entry with cement. Provide with conduit end bells.

F. Utility Co. boxes shall be per their requirements. Provide with ground rod as required.

G. The metal covers of lighting and power pull boxes shall be ground bonded to the circuit

grounding conductor(s) in the pull box. The size of the bonding conductor shall be the same size as the associated circuit ground conductors.

2.12 BACKBOARDS

A. Backboards shall be 3/4" plywood, type A-C grade fire treated for interior use, and type Exterior Grade for outdoor use. Backboards located outdoors shall be provided with one coat primer and two coats of exterior paint. Backboards in terminal cabinets shall be same as for interior use.

2.13 TERMINAL CABINETS

A. Terminal, relay, and contactor cabinets shall be code gauge, size as indicated with appropriate trim for mounting as indicated, with hinged door and cylinder type locks. NEMA-1 for indoor use in dry areas and NEMA-3R for outdoor use or in wet locations. Surface mounted cabinets shall not have knockouts. Provide backing plate/board for mounting equipment. Circle A-W or equal.

B. Provide engraved plastic label per section 26 00 00. Label shall identify the type of cabinet and designation, example "FIRE ALARM - FCA" and "EXTERIOR LIGHTING - RA".

2.14 LIGHTING CONTACTORS

A. Contactors shall be UL listed, rated minimum 30 amps at 120/277/480 Volts, electrically operated, for all types of lighting loads. Short circuit withstand rating shall exceed maximum available short circuit amps. Coil voltage shall match control voltage. Square-D class 8903 type LO (electrically held) and LXO (mechanically held) or equal.

B. Contactors shall be installed on vibration isolators in Relay cabinets appropriately sized.

2.15 GROUND RODS

A. Ground rods shall be 3/4 in dia. x 10 ft. copper clad steel.

2.16 SURGE PROTECTIVE DEVICE (SPD)

(Transient Voltage Surge Protector TVSS)

A. Where indicated at main service entrance, provide internally mounted SPD, Square-D SurgeLogic, Eaton Cutler-Hammer, G.E. or equal. Where internal mounting is not practical provide externally mounted with close nipple connection, Leviton 57000 Series or equal.

1. Minimum surge current rating: 160 kA per phase.

2. Clamping performance rating per UL1449 3rd edition:

| Mode | 120/208V | 480/277V |
|---|---|---|
| L-N | 400V | 800V |
| L-G | 400V | 800V |
| N-G | 400V | 800V |

B. Where indicated at panels and other than main service locations, provide internally mounted SPD, Square-D SurgeLogic, Eaton Cutler-Hammer, G.E. or equal. Where internal mounting is not practical provide externally mounted with close nipple connection, Leviton 52000 Series or equal.

1. Minimum surge current rating: 100 kA per phase.

2. Clamping performance rating per UL 1449 3rd edition:

| Mode | 120/208V | 480/277V |
|---|---|---|
| L-N | 400V | 800V |
| L-G | 400V | 800V |
| N-G | 400V | 800V |

C. SPD devices shall be Listed and Component Recognized in accordance with:

1. UL 1449 Third Edition.

2. UL 1283.

3. NEMA LS-1 (1992) Low Voltage Surge Protective Devices.

4. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits, Category-C.

5. ANSI/IEEE C62.45, Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

6. Comply with CEC Article 285.

D. The SPD shall be rated to withstand the available fault current.

E. Noise rejection at 50 Ohms, 5K - 100 MHz dB = -20 to -40.

F. Maximum Continuous Operating Voltage (MCOV) shall be at least 115% of the nominal voltage. MOV's to be minimum 34mm diameter.

G. Features shall include clamping envelope tracking, parallel-operated, built-in redundancy provides complete protection on all phases, modular design allowing replacement of modules, normal mode and common mode protection for WYE-configured 3-phase systems, fuse protection for each module. Limited 5-year warranty.

H. The preferred method is to have the SPD unit internally mounted, which is either mounted directly to switchboard/panel bussing or within its enclosed compartment. Where external mounted unit is used, provide metal enclosure with hinged metal cover. External units shall be installed directly adjacent to panel it is protecting using close nipple connection. Provide in NEMA-3R cabinet where installed outdoors. Approx. size of 15.1"H x 13.1"W x 5.2"D.

2.17 SURFACE METALLIC AND NONMETALLIC RACEWAYS

A. The surface raceway system for branch circuit wiring and/or data network, voice, video and other low-voltage wiring shall be manufactured by the Wiremold Company, or equal. Raceway series as indicated on the plans. The raceway and all system components must be UL listed and exhibit non-flammable self-extinguishing characteristics. The raceway shall be a two-piece design with a base and a snap-on cover.

1. The nonmetallic raceway base and cover shall be manufactured of rigid PVC compound, available in ivory color. Exposed cuts shall be covered with cover clips.

2. The metal raceway base and cover shall be manufactured of galvanized steel, ivory finish and suitable for field painting.

B. A full compliment of fittings must be available including, but not limited to flat, internal and external elbows, tees, entrance fittings, boxes, covers, adapters, cover clips, and end caps. The fittings shall match the base and cover, and be of matching colors. All fittings shall be supplied with a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other Wiremold series raceways. Field cuts shall be clean, straight, and true with no rough edges.

C. For multicompartment raceways, device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall be available for mounting up to four devices at one location. Faceplates shall match and fit flush in the device plate and shall overlay the cover and base to hide uneven cuts. They shall match the raceway base and cover. The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (i.e. data jacks), STP (150 ohm), Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting.

D. Work shall include furnishing all raceway and appropriate fittings and device plates to install a nonmetallic surface raceway system. Installer shall comply with detailed manufacturer's instruction sheets, which accompany system components as well as system instruction sheets.

2.18 COVER PLATES

A. Switch and receptacle cover plates shall be smooth nylon type. Cover plates for other devices/outlets such as data, telephone, television, etc. shall be nylon. Cover plate color shall be ivory, matching all systems.

B. For multi-purpose rooms, gymnasiums, kitchens, locker rooms, toilet/restrooms, and walls such as CMU, brick, concrete block, and concrete walls, device plates shall be smooth stainless steel with beveled edges.

C. Each receptacle shall have its circuit identification on the cover plate (i.e., "LA1-12"). Use typewritten "clear tape". Use black letters/numbers. Clean surface before adhesive tape is applied, and wrap tape around each end to prevent pealing.

1. For floor boxes, plates shall be engraved with circuit identification.

PART 3 EXECUTION

3.1 CONDUITS

A. All conduits shall be rigid steel except EMT may be used at following locations:

1. In dry locations in concealed furred spaces.

2. In partitions other than concrete, concrete block, or solid masonry.

3. For exposed work indoors in mechanical rooms, not finished classrooms, kitchens, shops, offices and multi-use rooms.

4. Conduits exposed in Gymnasiums and Multi-Purpose Rooms shall be rigid steel up to 25 ft.

5. In mechanical rooms not subject to hazardous materials

6. EMT may not be used on the exterior on the roof

7. Concealed above suspended ceilings or ceilings directly attached to structure above.

B. Flexible conduit shall be used to provide flexible connections of short length (3 ft or less) to equipment subject to vibration or movement and to all motors. . Provide a separate bonding conductor in all flexible connections/conduit. Flexible conduit shall be one continuous length without couplings.

C. Run conduit concealed in areas having finished ceilings and in walls. Run all cross conduits and vertical risers or drops concealed in wall and/or partitions. Should it be necessary to notch any framing members, make such notching only at locations and in a manner as approved by the Architects. Where concealing conduit is not possible or practical, conduit may be run exposed in areas only where so permitted by the Architect. Install exposed conduit run neatly, parallel to or at right angles to structural members. Maintain a minimum of 6" clearance from steam or hot water pipes.

D. Support conduit with straps and secure to wood structure by means of bolts or lag screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Expanders and shields shall be steel or malleable iron.

E. Do not install in concrete slabs.

F. Conduits installed in contact with ground shall be PVC-40 conduit.

1. Provide a minimum 2" of sand bedding at the bottom of the trench before laying conduits. Maintain 2" separation between conduits. Maintain 12" separation between power conduits (120 Volts and greater) and low voltage signal conduits.

2. Backfill shall be sand, from bottom to 12" below finished grade. Fine earth native backfill to be used for the last 12".

3. Risers, including elbows, shall be double-wrapped rigid steel or PVC coated rigid steel conduit; except that risers, including elbows and bends, at in-ground pull box locations shall be PVC-40 terminated with endbells.

4. When installing underground conduits to specified depth, depth shall be taken from the top of the conduit to the finished grade level. Unless otherwise specified, underground conduits outside of foundation line shall be installed with top side not less than 24" below finished grade.

   a. Conduits 1.5" and larger inside foundation line shall be below subgrade.
   b. Conduits 1.25" and smaller inside foundation line shall be installed on the subgrade, only one conduit high. Conduits shall cross under subgrade. Secure conduit to subgrade to prevent "floating".
   c. Backfill material within foundation line shall be sand.

5. Utility Company (electric, telephone, cable TV, etc.) conduits shall be installed per their depth and backfill requirements. Minimum depth shall be 24" below finished grade. Minimum conduit shall be PVC-40. Where the utility company allows use of a "lesser" grade conduit, i.e. DB120, PVC-40 shall be used.

6. The minimum size of conduits outside the foundation line shall be 1", 3/4" inside the foundation line.

7. Bends shall be wide sweeping type with minimum 24 inch radius bends.

8. Manufactured elbows are required to be used for all 22.5 and 45 degree bends, and 90 degree elbows, and combinations thereof. Field bends may be used for other bends with approved field benders specifically for such purpose and such bends shall not compromise the integrity and nominal thickness of the conduit wall.

9. For all trenches, provide a 6" wide non-biodegradable metal-detectable polyethylene tape at 12" below grade, 5-mil thick, labeled " CAUTION ELECTRIC LINE BURIED BELOW". Fluorescent red for electric power conduits and fluorescent orange "TELECOMMUNICATIONS" for telephone and signal conduits. Use Fluorescent red for common trenches. Tape shall be continuous for full length of trench.

G. Support individual conduits with 2-hole steel straps. 1-hole steel straps may be used for conduits 1" and smaller concealed in wall or above ceilings.

H. Galvanized iron hanger rods sizes 1/4" diameter and larger with spring steel fasteners, clips or clamps specifically designed for purpose for conduits up to 1" size may be used.

I. Individual conduits 3/4" and smaller run above wire suspended ceilings may be supported from independent hanger wires with approved spring steel clips. Wire ties will not be acceptable. Wire shall be taut and secured to ceiling and structure above.

J. Support multi-parallel horizontal conduit runs with trapeze type hangers consisting of two or more steel hanger rods, cross channels, J-bolts, clamps, etc.

K. Sizes of rods and cross channels shall be designed to support four times actual load. Hanger rods shall have safety factor of 5 based on ultimate strength of material used.

L. Conduits for data, telecommunications, signal, video, TV, and/or containing fiber optic, coaxial, or OSP (outside plant) multi-pair cables shall have a minimum inside bend radius per CEC Table 346-10 (do not use exception); except that conduits 2" to 4" shall be minimum 24" radius bends.

M. After installation of conductors, all conduits routed below grade shall be sealed at each opening, including risers and in pull boxes, to prevent the entrance of water and debris.

N. Conduits not terminated into a box or cabinet, such as stubbed to a backboard, shall be terminated with an insulated bushing. Bushings for metallic conduits shall be metallic type secured by set screw, compression, or threaded type. Bushings for PVC conduits shall be glued in place.

O. Although circuiting is shown as diagrammatic, their point-to-point destinations and their indication of above/below ground route shall be followed as much as possible. Where site conditions dictate that an alternate means of routing will alleviate conflicts, the alternate means will be considered with prior approval by the Engineer.

P. Where cinder fill is encountered in Block walls, conduit shall be PVC-40 where in contact with cinder fill. Boxes shall be PVC type where in contact with cinder fill.

Q. Horizontal runs of conduit above suspended wire lay-in ceilings shall not be less than 12"

above the ceiling.

R. Maintain 12 inch separation between power circuits (>120V) and all signal circuits (data, telephone, speaker, clock, etc.) to prevent interference.

S. Feeder conduits connected to panels/switchboard shall have ground lug bushing connected to equipment ground buss with ground wire same size as largest ground wire in the panel/switchboard.

T. Conduits penetrating through the roof shall be secured within 12" below roof and supported within 12" of the penetration on the roof.

U. Where conduits cross building expansion/seismic joints provide a short length of flexible conduit (do not exceed 6 ft.) and fittings listed as a grounding means, or in locations where flex conduit cannot be used provide UL listed expansion/seismic fittings.

V. Conduits concealed in any masonry shall be routed in a conduit sleeve. Such sleeves shall not be placed closer than 3 diameters, center to center.

W. Conduits to air conditioning (AC) equipment, fans, or other roof mounted equipment shall rise up from the ceiling below through the equipment curb or conduit window within the equipment, if allowed by equipment manufacturer, to prevent additional roof penetrations.

X. Where conduit passes through finished walls or ceilings, provide steel escutcheon plates, chrome or painted as directed. Conduit which penetrate floor slabs, concrete or masonry walls shall be grouted and sealed watertight at penetrations.

Y. Conduits shall be terminated to panels, cans, junction boxes at both ends.

Z. Do not combine circuits in a conduit without engineer’s approval.

AA. Cables and Raceways installed under metal-corrugated sheet roof decking shall maintain a minimum 1.5" from the nearest surface of the roof decking per CEC. This shall not apply to RMC or IMC.

3.2 CAPPING

A. Cap conduits during construction with manufactured seals. Swab out conduits before wires are pulled in.

B. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of water and debris, attach pull string to cap.

3.3 FLASHING

A. Make conduit projecting through roof watertight by proper flashing. Secure a sheet lead cap with a tightening bend to conduit. Use two collars for tar or asphalt composition roofings. Set one collar directly on roof deck and second collar set over on top of roofing felts. Lead sheet flashing shall be made of 4 lb. sheet lead.

3.4 PENETRATIONS OF FIRE RESISTIVE WALLS AND PARTITIONS

A. Penetrations of protected openings (fire rated walls, ceilings, floor-ceilings, roofs, etc.) shall be protected in accordance with the California Building Code, Part 2, Chapter 7, Title 24. Penetrations shall apply to conduits (raceways), cable trays, boxes, cabinets, panels, cables, etc.

B. Fire stopping shall be provided at penetrations of fire resistive walls, floors, ceilings, floor-ceiling assemblies, and roofs. Fire-stopping shall have a "F" and/or "T" rating as determined by tests conducted in accordance with ASTM E 814 or UL-1479. Fire stopping system/materials shall be UL Listed.

3.5 ACCESS DOORS

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of electrical systems; for example, inaccessible areas and attics containing heat detectors, junction boxes, etc. Access doors shall provide for complete removal and replacement of equipment. Provide fire rated access doors where located in fire rated partitions.

3.6 BOXES

A. Nails shall not be used to support outlet boxes. Boxes must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. For metal stud construction, use metal box hangers only. Box hangers shall be securely tied or welded (where permitted) or screwed to metal studs. Paint weld with rust inhibitor. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.

1. Outlet boxes with receptacles or switches: Provide a solid pigtail (green) ground wire grounded to the metallic outlet box. Pigtail shall also ground device and separate ground conductor if available. Size of ground wire to match overcurrent protection.

B. Locate outlets at the following heights above floor to the center of the device or handle unless otherwise noted on Drawings or in Specifications.

1. The top of the outlet box shall not be higher than 48" above finished floor, and the bottom of the outlet box shall not be less than 15" above finished floor. For forward or side approach over counter, maximum 44” and 46” respectively to top of box.

2. Convenience Outlets: 18" (4" above counter or splash).

3. Local Switches: 45".

4. Telephone Outlets: 18" (45" for wall phone).

5. Data, TV Outlets: 18".

6. Where devices are shown at counter locations, they shall be located approximately 4" above counter, clearing back-splash where applicable.

7. Refer to elevations and details on Architectural Drawings for exact heights and locations of all electrical outlets for switches, receptacles, special equipment, etc. Where above heights do not suit building construction or finish, consult Architect.

C. Install pull boxes or junction boxes as required in accessible spaces but do not install in finished areas unless approved by Architect.

D. Where fire rated construction is required (refer to Architectural Drawings), do not locate electrical outlet boxes back-to-back. Provide a minimum of 24" horizontal separation between outlet boxes on opposite side of the same wall. Where such restrictions cannot be met,

provide fire-stopping around box such as 3M Moldable Putty Pads or equal.

E. Boxes up to 100 cubic inches located in suspended wire ceilings may be supported through an independent hanger wire with approved tension clips. Wire shall be taut. Secure wire to the structure above and the ceiling below.

3.7 CONDUCTORS

A. Splices and joints for #10 AWG or smaller wiring shall be twisted together electrically and mechanically strong and insulated with approved type insulated electrical spring connectors, Scotchlok or Ideal. Joints and connections for #8 AWG or larger shall be made with Burndy, T & B, or approved equal, solderless tool applied pressure lugs and connectors. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire and with all irregular surfaces properly padded with "Scotchfil" putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1, or approved equal. Feeder splicing is not permitted.

1. In special instances where feeder splicing is allowed by the Engineer, it shall be made with high compression sleeve type connector followed by manufactured splicing kit utilizing as insulators, resins poured into a ready-to-use plastic mold to provide a uniform, moisture-proof tough, impact-resistant insulation.

2. Conductor splices below grade shall meet ANSI C119.1-1986 and UL 486D Standards. Raychem WCSM or FCSM heavy wall heat shrink tubing; or RVS or RVC series if use of flame heat is prohibited. Conductors to be joined with compression sleeve connectors.

3. Fire alarm and intercom may not be spliced.

B. Use only UL approved wire pulling compound as lubricant.

C. Lace conductors together with waxed linen lacing cord, T & B "Ty-Rap", Holub "Quik-Wrap" or equal, in a neat and workmanlike manner in panelboards, wireways, raceways, pull boxes and similar locations.

D. #12 AWG wire shall be minimum size wire used for lighting and power circuits. Motor control circuits may be #14 except as marked on Drawings, unless shown.

E. Provide cable supports in risers by means of a clamping device with insulated wedges or "Kellem" grips.

F. All conductors shall be in conduit unless otherwise indicated.

G. Conduit sizes shall be based on code fill table for THW insulated wires to accommodate the number, size, and type of wires shown or specified.

H. Wiring installed in pull boxes or junction boxes, where wire is pulled through without terminations (except splices), shall have a service loop around the interior of the box for 360 degrees utilizing the largest circumference.

I. Use #10 AWG conductor for 20 Amp 120 Volt circuit home runs longer than 75 feet, and for 20 Amp 277 Volt circuit homeruns longer than 200 feet.

J. Where conductors are increased in size and number (such as for voltage drop reasons), such that conductors will not fit the standard breaker or panel lugs, terminate conductors in one of the following means:

1. Provide larger breaker frame or panelboard.

2. Provide oversized lugs.

3. Last option only with approval from Engineer: Terminate wires in multiport connector and provide pigtail. Splice to be made in panel or switchboard if space is available, or in separate splice box. This option will not be normally granted.

3.8 PANELS AND CABINETS

A. Recessed enclosures (panelboards, terminal cabinets, cabinets, control cabinets, etc.) shall be provided with a minimum of three 3/4" empty conduits stubbed into accessible space above the ceiling. Drawings may require additional conduits.

3.9 GROUNDING

A. Grounding and ground bonding of the electrical installation shall be in accordance with CEC Article 250, and any applicable codes. Ground fittings shall be approved manufactured type, installed and connected to conform with Code requirements.

B. Neutral conductors and noncurrent-carrying parts of equipment at each installation shall be grounded in accordance with applicable code. Ground conductor shall be copper having a current capacity sized in accordance with CEC.

C. All equipment cases, motor frames, etc., shall be completely grounded to satisfy requirements of CEC. Install bond wire in flexible conduit. Install copper bond wire, sized in accordance with CEC, in all nonmetallic raceways and bond to all metallic parts using approved fittings.

D. Service ground conductor shall be connected to a "Ufer" encased ground and bonded to the metallic cold water pipe system and to the metallic natural gas line.

E. Interior metallic cold water pipe system and other interior metallic piping systems shall be ground bonded to the building grounding system.

F. Each building shall be provided with a grounding electrode connected to the metallic enclosure of the building disconnecting means. Grounding electrode conductor shall be sized per CEC table 250-66.

G. Total ground resistance shall not exceed 25 ohms.

H. All connections shall be made with solderless connectors or molded fusion-welding process.

I. Equipment grounding conductors shall be insulated with a continuous green outer finish along its entire length. Conductors size #4 AWG and larger may be identified (with green electrical tape applied half-lapped) at each end and at every point where the conductor is accessible. Tape shall be applied from its point of entry to point of exit or termination.

J. Insulated grounded (neutral) conductors shall be identified with a continuous white outer finish along its entire length. Neutral conductors #4 AWG or larger can be identified by a distinctive white marking (applied half-lapped with white electrical tape) for the last 12 inches at each end.

K. Where equipment is 1000 Volts or above, fence grounding shall be provided per CEC.

1. Provide a ground rod at each corner fence post and at line posts at least every 40 ft.

Ground rods to be 5/8" x 8 ft buried below grade.

2. All ground conductors to be minimum #2 bare copper. Ground conductor to be buried 30" below grade following outside fenced enclosure. Provide ground connections between ground rods, at fence posts, at gate posts, to equipment, etc. for a complete looped system.

3. Each gate post shall be grounded and provide flexible braided copper strap ground connection to gate. Corner gate post shall have a ground rod.

4. Ground equipment rated 1000V or higher to ground conductor.

5. Connections to be exothermic welds or ground clamps rated for such use.

6. Each gate shall be bonded to its gatepost by flexible braided copper strap.

3.10 FIELD TESTS

A. General: Perform field test in the presence of the Owner's Representative except as otherwise specified. Provide required labor, materials, equipment and connections to perform tests. Document results and submit them to the Owner's Representative. Repair or replace all defective work.

B. Perform Insulation Resistance (IR) "Megger" Testing per NETA Standards. Submit test results. Provide testing for:

1. All feeders 100 Amps and higher.

2. Branch circuits 100 Amps and higher.

3. Provide test results for all “Megger” tests.

C. Verify operation of starters and install overload protection devices sized in accordance with the motor full load current.

D. Each ground rod shall be tested. A ground rod which does not have a resistance to ground of 25 ohms or less shall be augmented by one additional ground rod at no less than 8 feet from each other.

3.11 CIRCUIT BREAKER COORDINATION

A. Provide protective device (fuses and breakers) coordination study on the distribution system to determine circuit breaker settings for electronic breakers and other breakers with adjustable tripping characteristics, and all protective devices 300 amps or more. The coordination shall be with the immediate downstream and upstream protective device(s).

B. Plot time-current characteristics of the specified protective devices using log-log paper. Include the following minimum information, as pertinent to system, on plots:

1. Complete titles.

2. Representation One Line Diagram and legends.

3. Power company's relays or fuse characteristics.

4. Complete operating bands of low voltage circuit breaker trip curves.

5. Fuse curves.

6. Protective relay type selected and curves.

   Maintain reasonable coordination intervals and separation of characteristic curves on plots. Provide sufficient curves to clearly indicate the coordination achieved to the main breaker, feeder breakers and load protective devices rated 300 amperes or more.

C. Summarize the results of the power system study in a bound final report. Organize the report using the following sections:

1. Description, purpose, basis, written scope, and a single-line diagram of the portion of the power system which is included within the scope of study.

2. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

3. Provide a separate tabulated list for the selection and settings of the protective devices. Include the following minimum information:

   a. Circuit identification.
   b. IEEE device number.(Where applicable)
   c. Manufacturer, device type and range of adjustment.
   d. Recommended settings.

3.12 GROUND FAULT PROTECTION AND TESTING

A. Where indicated on the plans, provide circuit breaker with ground fault protection. The ground fault system shall include a memory circuit for positive tripping action despite intermittent arcing ground faults.

B. Provide an integral means of testing the ground fault system to meet the on-site requirements of CEC Articles 230 and 517.

C. Provide acceptance testing per InterNational Electrical Testing Association Inc. (NETA) specifications and standards. Submit test results.

3.13 CLEANING

A. Brush and clean work prior to concealing, painting and acceptance. Performed in stages if directed.

B. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance.

C. Remove debris from inside and outside of material, equipment and structures.

3.14 WARRANTY

A. All materials and installation shall be provided with a one (1) year warranty which shall include replacement parts, labor, retesting, and travel to and from the job site. The warranty period shall begin after final acceptance of the project.

**END OF SECTION 26 05 00**

# SECTION 26 07 00 - COMMISSIONING OF ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

A. See Section 01 91 13 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 91 13.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire electrical system is to be commissioned, including commissioning activities for the following specific items:

1. Sensor placement and orientation for all sensor types.
2. Occupancy sensor function, sensitivity, and time delays.
3. Daylight harvesting sensor calibration.
4. Automated shade operation.
5. Manual control placement and operation.
6. Automated control operation, including scheduled on/off functions and dimming trims and presets.
7. Override operation, access, and functionality.
8. Centralized control interfaces and operation.
9. Client education of operations.
10. Documentation archived to client.
11. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED REQUIREMENTS

A. Section 01 77 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

B. Section 01 91 13 - Commissioning: Commissioning requirements that apply to all types of work.

C. Section 26 09 43 – Network Lighting Controls.

D. Section 26 08 00 – Electrical Acceptance Tests.

1.3 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

1. System name.
2. List of devices.
3. Step-by-step procedures for testing each controller after installation, including:
   a. Process of verifying proper hardware and wiring installation.
   b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
   c. Process of performing operational checks of each controlled component.
   d. Plan and process for calibrating all sensors.
   e. Description of the expected field adjustments for controllers and sensors should control responses falling outside of expected values.
4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.

C. Startup Reports and Prefunctional Checklists: Submit for approval of Commissioning Authority.

D. Electrical System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
   a. Floor.
   b. Room number.
   c. Room name.
   d. Sensor ID.
   e. Reference drawing number.
   f. Control device ID.
   g. Controlled components address.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and electrical drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Sensors and DP switches.
    f. Program setups (software program printouts).

E. Project Record Documents: See Section 01 78 00 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all sensors and control devices on project record drawings.

F. Training Manuals: See Section 01 79 00 for additional requirements.

1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for equipment start-up and testing, adjusting, and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when system testing, startup and adjusting will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all electrical systems into operation and continue operation during each working day of testing, adjusting, and commissioning, as required.

3.2 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

3.3 OPERATION AND MAINTENANCE MANUALS

A. See Section 07 78 23 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.4 DEMONSTRATION AND TRAINING

A. See Section 01 79 00 for additional requirements.

B. Demonstrate operation and maintenance of electrical system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide the services of manufacturer representatives to assist instructors where necessary.

## END OF SECTION 26 07 00

# SECTION 26 08 00 - Electrical Acceptance Tests

PART 1 GENERAL

1.1 SUMMARY

A. This Section defines the Electrical Acceptance Tests and checks that shall be made on all electrical equipment and wiring to ensure compliance with all applicable Codes and Standards, and with the requirements of the Contract Documents.

B. All electrical equipment testing and related costs shall be included in the Contractor's bid.

1.2 GENERAL REQUIREMENTS

A. The Contractor shall test equipment of all kinds installed on this project to determine whether it fulfills the requirements of these Specifications. The Contractor shall furnish all labor necessary to adjust the operation of the apparatus and make the connections for the tests. After the tests have been completed, the Contractor shall restore all connections, apparatus, etc., to their original condition.

B. The Contractor shall retain the services of a qualified Independent Testing Agency holding a valid current C-10 License to perform certain tests and prepare reports, as enumerated in the following Articles. The Independent Testing Agency shall be a company that specializes in electrical equipment testing and shall be NETA or NICET certified.

C. Contractor shall obtain approval from the architect of proposed independent testing agency(s) before any testing is started.

D. Electrical systems, equipment and materials shall be tested prior to final acceptance of the work.

1.3 INDEPENDENT TESTING AGENCY REQUIREMENTS

A. The Independent Testing Agency shall furnish personnel acceptable to Engineer to conduct all testing. Supervising engineer shall have a minimum of five years experience in testing of equipment of the type to be tested on this Project.

B. The Independent Testing Agency shall furnish all labor required for and incidental to testing.

C. The Independent Testing Agency shall provide minor field repairs, adjustments, and wiring modifications at the time of inspection and testing.

D. The Independent Testing Agency shall furnish all necessary test equipment to satisfactorily perform all tests specified herein.

E. The Independent Testing Agency shall check all devices for proper operation - checking for wear, tightness, dirt, etc.

F. The Independent Testing Agency shall check for conformance to published curves.

G. The Independent Testing Agency shall notify and coordinate with the Owner's representative at least 3 working days prior to the commencement of any Electrical Acceptance Testing. Tests shall be witnessed by the Owner's representative unless such witnessing is waived in writing by the Owner's Representative.

1.4 CODES AND STANDARDS

A. Current California Electrical Code (CEC).

B. National Electrical Manufacturer's Association (NEMA).

C. Manufacturer's Instructions and Maintenance Manual applicable to each particular apparatus.

D. OSHA Rules and Regulation.

E. National Electrical Testing Association (NETA) "Acceptance Testing Specifications".

F. Procedures as directed by Engineer.

1.5 CARE AND PRECAUTIONS

A. Contractor shall be responsible for any damage to equipment or material due to improper test procedures or test apparatus handling, and shall replace or restore to original condition, any damaged equipment or material.

B. Contractor shall furnish and use safety devices such as rubber gloves and blankets, protective screens, barriers, and danger signs to adequately protect and warn all personnel in the vicinity of the tests.

1.6 EQUIPMENT TO BE TESTED BY CONTRACTOR

A. Perform the visual inspections, manual operations and tests on systems and equipment as described in Part 3, "Execution".

B. Switchboard

C. Molded Case Circuit Breakers Rated Less Than 100A

D. Distribution Transformers

E. Disconnect Switches

F. Lighting

G. Title 24 Acceptance Testing

H. Fire Alarm System

I. Communication System

1.7 EQUIPMENT TO BE TESTED BY INDEPENDENT TESTING AGENCY

A. Circuit Breakers Rated 100A and Greater

B. Grounding System

C. Switchboards and Panels

D. Power Cable

1.8 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 1 Specification Sections and Specification Section 16010.

B. Test Reports

1. Provide written test reports, signed and dated, for all tests prior to acceptance of the tested equipment by the Owner.

2. Submit certified reports of Independent Tests and Observations indicating and interpreting test results specified in Part 3 of this Section.

a. The Test Report shall include the following:

1) Description of equipment tested.
2) Description of test procedure.
3) Calibration record for all testing devices used.
4) Test results.
5) Recommendations.
6) Appendix, including all field test reports.

b. Furnish six copies of completed report to the Electrical Engineer no later than ten days after test completion unless requested otherwise by Owner.

c. Instrumentation-Traceability: The testing agency shall provide calibration labels for all relays and circuit breakers tested.

d. Labels shall be self-adhesive and placed on covers or frames so as not to obscure nameplate, tap block or time dial. Label shall indicate date tested and firm name.

PART 2 PRODUCTS

2.1 TESTING EQUIPMENT

A. Furnish suitable electrical instruments including voltmeters, ammeters, wattmeters, tachometers and all other equipment necessary to perform tests specified.

B. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment and devices necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

2.2 TESTING COORDINATION

A. Coordinate activities and cooperate with others on the Project to ensure that systems are energized when required, when loads are applied, and that other requirements of this Section of the Specifications are carried out in a timely, coordinated basis.

B. Conduct tests in the presence of the Architect/Engineer and the Construction Manager. Notify the Architect/Engineer and Construction Manager seven calendar days or more in advance when any test is to be performed, and do not start tests without the permission of the Architect/Engineer and Construction Manager.

C. Make up no permanent connections until correct phase sequence of all equipment is determined.

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall provide Acceptance Testing on the entire Electrical System. Certain of this testing shall be performed by an Independent Testing Agency as indicated.

B. Acceptance Testing shall include Visual Inspections, Manual Operations, Electrical Tests, and Functional Testing.

C. Whenever possible, all Visual Inspections, Manual Operations and Electrical Tests shall be made just prior to energizing the equipment or circuits, and shall be coordinated with the field schedule and field conditions.

D. Test reports on megger, dielectric absorption and high potential tests shall include the ambient temperature and relative humidity existing at the time of the tests.

E. Should any piece of apparatus or any material or work fail during any of these Tests, it shall be immediately removed and be replaced by perfect material by this Contractor at his expense and the portion of the work replaced be again tested by the Contractor.

F. Before testing and energizing a system, all necessary precautions shall be taken to ensure the safety of personnel and equipment. All conductors and all electrical equipment shall be properly insulated and enclosed. All enclosures for conductors and equipment shall be properly grounded. Insulation resistance measurements must have been made and approved on all conductors and energized parts of electrical equipment.

1. During actual testing, the Contractor or Independent Testing Agency shall:

a. Ensure that temporary power terminations are connected in such a manner that commercial power may be restored in forty-five minutes upon request.
b. Place temporary power cables out of the way in a safe manner that provides no hazard to personnel or equipment in the area.
c. Provide all special connections required.
d. Conduct all tests in presence of the representative except where advised this would not be necessary.

G. The entire installation shall be free from short circuits and improper grounds. Test shall be made in the presence of the Architect, his Engineer or his representative. Panels and circuits shall be tested for grounds and shorts with mains disconnected from the feeder, branches connected, lamps removed or omitted from the sockets and all wall switches closed. Each individual circuit shall be tested at the panel with the equipment connected for proper operation

H. The following minimum tests are required, but shall not be limited to this list. Tests will be supervised and witnessed by the Architect/Engineer and Construction Manager:

1. Proper phase rotation.

2. Short circuits.

3. Improper grounds.

4. Power and control electrical circuits for circuit continuity and function test.

I. Furnish all personnel, labor, meters, instruments, cable, connections, equipment and apparatus necessary for making all tests.

J. Check and test all switchboards, transformers, panelboards, feeders, power and control cables, communication system devices and wiring, and all connections to all equipment.

K. After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. If fault condition is present, the trouble shall be rectified and the wiring system shall be retested.

L. A voltage test shall be made at each lighting panel, distribution panel and at the last outlet on each circuit. If drop in potential exceeds one percent, correct the condition by locating the ground or high resistance splice or connection and retest.

M. Any wiring device, electrical apparatus, or lighting fixture grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing the defective parts or materials.

N. The Architect/Engineer will conduct from time to time such tests as may be required to any part of the equipment to determine if it is installed in accordance with specifications. Extend to the Architect/Engineer all facilities to this end and furnish skilled or unskilled help required.

O. All final tests shall be witnessed by the Architect/Engineer and Construction Manager and three copies of the verified test results shall be given to the Architect/Engineer and Construction Manager promptly upon completion of a test.

P. Provide assistance to the various equipment manufacturers' field engineers as required in the testing and adjusting of the electrical power and control equipment. Cooperation shall be such that a minimum of time is required for equipment testing.

Q. A log shall be maintained for all tests. This log shall be certified before completion of the project, both as to test value and date of test. All major equipment such as the switchboard and panelboards shall be energized initially in the presence of the Architect/Engineer and Construction Manager.

R. The Owner reserves the right to operate any system or equipment prior to final completion and acceptance of the work. Such preliminary operation shall not be construed as an acceptance of any work. Each piece of equipment and all of the systems shall be adjusted to insure proper functioning and shall be left in first class operating condition.

3.2 VISUAL INSPECTIONS

A. Prior to Manual Operation and Electrical Testing, perform Visual Inspections to verify the following:

1. The equipment is completely and properly installed.

2. The equipment is free from damage and defects.

3. Shipping blocks and restraints have been removed.

4. Electrical terminations have been properly tightened.

5. The equipment has been properly aligned.

6. The equipment has been properly lubricated.

7. The ventilation louvers are open and unobstructed.

8. Voltages and phases have been properly identified.

9. Terminations in control panels have been properly identified.

10. The equipment is ready to be tested

3.3 MANUAL OPERATION

A. Prior to any Electrical Testing, mechanical devices shall be exercised or rotated manually to verify that they operate properly and freely.

3.4 ELECTRICAL TESTS BY CONTRACTOR

A. Switchboard

1. The Contractor shall perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Sections 7.1, 7.6, 7.9, 7.10, 7.11, and 7.14, as appropriate. Certify compliance with test parameters.

2. Switchboard and completed installation shall be inspected for adequate size, bus spacing, bracing, physical damage, proper alignment, anchorage and grounding.

3. Switchboard frame will be inspected for alignment, level, and anchorage.

4. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque value. All bus bolts will be torqued to their proper value. A mark to be placed on each tightened bolt to ensure completeness.

5. Switchboard interior will be vacuumed and wiped clean.

6. The following tests and checks shall be performed before placing in operation:

   a. Check all new bus and cable connections for proper contact pressure and mark each bolt with a red "dot" of paint to indicate it has been checked.
   b. Check all the new equipment for mechanical adjustment, lubrication, and freedom of operation. Remove all shipping blocks.
   c. Operate and test trip units for all new breakers.
   d. Test all transfer switches and associated control circuits for correct connection and operation.
   e. Test all panel feeders and main breakers.
   f. Test ground fault systems by operating push-to-test button.
   g. Physically test key interlock systems to check for proper functionality.

7. Using a Megger, measure the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000VDC. Minimum acceptable value for insulation resistance is one (1) megohm. Refer to manufacturer's literature for specific testing procedure.

B. Molded Case Circuit Breakers rated less than 100A

1. Circuit breakers will be operated manually several times to ensure smooth operation.

2. Molded case will be inspected for cracks.

3. Rated current will be passed through each phase and millivolt readings taken across contacts.

4. Time current characteristic tests will be performed by passing 300% rated current through each phase and monitoring trip time.

5. Instantaneous pickup current will be determined by finding the current level at which the breaker trips out in less than 2 cycles.

6. Insulation resistance tests will be performed at 1000 Volts DC.

7. Circuit breaker covers will be removed on unsealed units and checked for cracks. Interphase barriers and arc chutes to be inspected. All bolts and lugs will be tightened. All internal auxiliary devices will be inspected.

8. Contacts, shunts, etc., will be visually inspected for wear and alignment.

9. Inverse trip time, instantaneous pickup current and millivolt drop across contacts, insulation resistance values, as well as deficiencies causing breaker to function outside published limits will be recorded. Times will then be compared with manufacturer's or NEMA published values.

C. Distribution Transformers

1. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 2.5 percent. Submit recording and tap settings as test results.

2. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

3. Prepare a written Output Settings Report recording output voltages and tap settings.

D. Disconnect Switches

1. Check for cleanliness of contacts, operation, etc.

2. Lubricate contacts and mechanical devices.

3. Check fuse-clip tightness.

4. Perform a 1,000-volt megger test on disconnect switches rated for 600V and at 500 volts for disconnect switches rated for 240V.

E. Lighting

1. Upon completion of installation of lighting fixtures and controls, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. The Contractor shall replace at his expense all noisy ballasts, broken or cracked lenses or other defective items. Where possible, correct malfunctioning units at site, then re-test to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

2. At the time of substantial completion, replace lamps in interior lighting fixtures, which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect or Electrical Engineer.

3. Replace defective and burned out fluorescent lamps for a period of one-year following the time of substantial completion

4. Give advance notice of dates and times for field tests.

5. Provide instruments to make and record test results.

6. Tests and Observations

   a. Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source.
   b. Check for excessively noisy ballasts.
   c. Contractor shall advice Owner at least 72 hours prior to testing emergency lighting system, and shall allow Owner to witness testing.
   d. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:

      1) Duration of supply
      2) Low battery voltage shutdown.
      3) Normal transfer to battery source and retransfer to normal.
      4) Low supply voltage transfer.
      5) Report results of tests in wiring.

F. Title 24 Acceptance Testing

1. Perform testing in accordance with the Building Commissioning plan and as required by the California Energy Code, Section 120.8.

G. Fire Alarm System

1. Perform testing in accordance with NFPA 72-2002, Chapter 10.

2. Perform tests as outlined in Part 3 of Specification Section 16720.

H. Communication System

1. Perform tests as outlined in Part 3 of Specification Section 16744.

3.5 INDEPENDENT AGENCY TESTING

A. Circuit Breakers rated 100A or greater

1. All circuit breakers, 100 amps or more, shall be tested by an independent testing agency in accordance with NETA specifications and a report submitted to the architect. Any circuit breaker that does not pass the test shall be replaced.

2. Circuit breakers will be operated manually several times to ensure smooth operation.

3. Molded case will be inspected for cracks.

4. Rated current will be passed through each phase and millivolt readings taken across contacts.

5. Time current characteristic tests will be performed by passing 300% rated current through each phase and monitoring trip time.

6. Instantaneous pickup current will be determined by finding the current level at which the breaker trips out in less than 2 cycles.

7. Insulation resistance tests will be performed at 1000 Volts DC.

8. Circuit breaker covers will be removed on unsealed units and checked for cracks. Interphase barriers and arc chutes to be inspected. All bolts and lugs will be tightened. All internal auxiliary devices will be inspected.

9. Contacts, shunts, etc., will be visually inspected for wear and alignment.

10. Inverse trip time, instantaneous pickup current and millivolt drop across contacts, insulation resistance values, as well as deficiencies causing breaker to function outside published limits will be recorded. Times will then be compared with manufacturer's or NEMA published values.

11. The testing agency shall provide calibration labels for all relays and circuit breakers tested. Labels shall be self-adhesive and placed on covers or frames so as not to obscure nameplate, tap block or time dial. Label shall indicate date tested and firm name.

B. Grounding System

1. Test shall be performed for every new SEPARATELLY DERIVED AC SYSTEM.

2. Ground tests shall meet the requirements of the California Electrical Code and comply with UL 467. The grounding electrode system at the main electrical service equipment shall be tested by an Independent Testing Agency in accordance with the three point fall of potential method as specified in IEEE Standard 81-1983. Maximum ground resistance shall be 5 OHMS. A copy of the test report shall be submitted to the architect and engineer of record.

3. Maximum grounding to resistance values are as follows:

   a. Equipment Rated 500 kVA and Less: 5 ohms.
   b. Equipment Rated 500 to 1000 kVA: 5 ohms.
   c. Equipment Rated More than 1000 kVA: 3 ohms.

4. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

5. The test agency shall remove the test link between the ground and neutral, and test the neutral for any parallel and/or superfluous ground paths. If any are found, a report should be given to the Engineer. No grounds are to be removed unless authorized in writing.

6. Ground electrode resistance shall be taken using a Biddle ground resistance meter and readings given to the report.

7. All ground connections in switchboard as well as that to cold water pipes shall be check for tightness and adequacy.

8. Measure the resistance to ground of each ground rod [in a ground mat] before connection to the other ground rods. The resistance shall not exceed 10 ohms.

9. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 2 ohms for primary services or 5 ohms for secondary services.

10. Tests of the resistance to ground shall be made using either the three point method or the fall-of-potential method.

11. Perform a continuity check from equipment ground bus bars and ground lugs to the ground system.

12. Ground rods for manholes and light poles need not be tested.

13. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

14. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Switchboards and Panels

1. The Independent Testing Agency shall perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Sections 7.1, 7.6, 7.9, 7.10, 7.11, and 7.14, as appropriate. Certify compliance with test parameters.

2. After Substantial Completion, but not more than 2 months after Final Acceptance, The Independent Testing Agency shall perform an infrared scan of each switchboard and panel.

   a. Remove fronts to make joints and connections accessible to a portable scanner.
   b. Use an approved infrared-scanning device designed to measure temperature or detect significant deviations from normal values.
   c. Provide calibration record for device used.
   d. Prepare a certified report identifying switchboards and panels checked and describing results of infrared scanning. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

D. Power Cable

1. The 600-volt insulated wires and cables shall be factory tested prior to shipment in accordance with ICEA Standards for the insulation specified.

2. Perform a continuity check and a 1,000 volt DC megger test on 600 volt power cables No. 6 AWG and larger as outlined in latest version NETA Acceptance Testing Specifications.

3. Phase conductors, if shorted, grounded or at fault shall be removed, shall be replaced and the wiring system shall be retested.

3.6 FUNCTIONAL TESTING

A. All automatic and manual functions shall be checked for proper operation.

B. All indicating circuits, lights and alarms shall be tested for correct operation. Burned out indicators shall be re-lamped.

C. Upon completion of the Work, place the entire installation in operation, test for proper function, and show systems and equipment to be free of defects.

END OF SECTION

# SECTION 26 09 00 - CONTROLS AND INSTRUMENTATION

## PART 1 GENERAL

### 1.1 DESCRIPTION

A. Provide electrical connections to various equipment. Such equipment includes motors, kitchen equipment, owner furnished equipment, etc. that is specified in other divisions of this specification. In addition, provide all controls and instrumentation as shown and specified.

### 1.2 WORK NOT INCLUDED UNDER THIS SECTION

A. Temperature control conduit and wiring included under Divisions 22 PLUMBING and 23 MECHANICAL, except as otherwise specified hereinafter.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

A. As specified in Section 26 05 00, BASIC ELECTRICAL MATERIALS AND METHODS.

B. COMBINATION LOAD EQUIPMENT: Provide overcurrent protection for multi-motor and combination load equipment in conformance with U.L. requirements. Provide overcurrent protective device in accordance with manufacturer's data plate attached to equipment actually installed whether shown or not without an increase in Contract Sum.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Provide all conduit and wiring from panelboards and/or the overcurrent protective device to kitchen, mechanical, owner furnished, and other equipment and make connection to equipment, motors, VFD's, and associated control apparatus as specified in the individual specification sections.

B. Provide connections to starters, variable frequency drives, controllers, and other related equipment for various motor units requiring electrical connection that is supplied as part of the work of other sections. Include the necessary anchors, sleeves and similar items to facilitate proper installation of the system.

C. Check and verify locations of all power operated devices and their related controls; coordinate with the work of other sections, and provide required overload protection, circuit and control conductors (except temperature controls) to each and all locations. Do not proceed with work without first verifying the accuracy of data.

D. TEMPERATURE CONTROL CONDUIT AND WIRING: Provided as part of the work of Divisions 22 PLUMBING and 23 MECHANICAL, including all interlock wiring between motor starter and temperature control equipment; however, if a device such as pneumatic electric relay is used as a motor starter on a branch circuit run, provide and connect branch circuit to device and from this device to motor. Provide control wiring between starters and pushbuttons or other manual starter switches and branch circuit power supply required for temperature control system.

E. WIRING: Except for temperature control wiring, encompass the correct installation of all overload protection, control wiring and adequate power supply, and proper operation of all electrical equipment associated with the mechanical equipment.

1. The responsibility for correctness of electrical connections and protective devices described hereinbefore, for operation of equipment furnished, installed or modified as part of the work of other sections shall be that of the other sections.
2. Before permitting operation of any equipment which is furnished, installed or modified under work of other sections, review all wiring connections which have an influence on equipment of work, and verify that these connections are correct. Ensure that overload protection devices installed are of correct type, rating and setting to properly protect said equipment.
3. Provide and install branch circuits and switches. Connect every electrical load wherever shown.

3.2 OVERLOAD PROTECTION

A. When not furnished as part of the work of other sections as part of packaged mechanical equipment units or as a separate magnetic starter, include thermal overload protection as follows:

1. For all motors 1/8 horsepower and larger that are controlled manually except as shown.
2. For all motors 1/30 horsepower and larger that are controlled automatically by means of such devices as thermostats, aquastats, time switches, pressure switches, float switches or other similar devices.
3. For all motors 1/30 horsepower and larger that are controlled manually out of sight of controller or more than 50 feet away.
4. Install proper thermal protection and disconnects in accordance with applicable CEC requirements for motors.

**END OF SECTION**

# SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Digital-network lighting control system and associated components:

1. Fluorescent electronic dimming ballasts.
2. LED drivers.
3. Power interfaces.
4. Lighting control modules (Lutron Energi Savr Node).
5. Digital dimming ballast and switching modules (Lutron EcoSystem).
6. Lighting management hubs.
7. Lighting management system software.
8. Control stations.
9. Low-voltage control interfaces.
10. Wired sensors.

### 1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 27 26 - Wiring Devices:

C. Finish requirements for wall controls specified in this section.

D. Section 26 51 00 - Interior Lighting: Luminaires and associated components, for interface with lighting control system.

E. Section 26 51 13 - Luminaires, Ballasts, and Drivers - Lutron.

### 1.3 REFERENCE STANDARDS

A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

B. ANSI/ESD S20.20 - Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices); 2007.

C. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2002a (Reapproved 2010).

D. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements; 2011.

E. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2008.

F. IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test; 2008.

G. IEC 61347-2-3 - Lamp Control Gear - Part 2-3: Particular Requirements for A.C. and/or D.C. Supplied Electronic Control Gear for Fluorescent Lamps; 2011.

H. IEC 61347-2-13 - Lamp Control Gear - Part 2-13: Particular Requirements for D.C. or A.C. Supplied Electronic Control Gear for LED Modules; 2006.

I. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

J. ISO 9001 - Quality Management Systems-Requirements; 2008.

K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

L. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.

M. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).

N. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

O. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

P. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

Q. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

R. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

S. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

T. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall controls with actual installed door swings.
3. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.

B. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

C. Preinstallation Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:

1. Low voltage wiring requirements.
2. Separation of power and low voltage/data wiring.

3. Wire labeling.
4. Lighting management hub locations and installation.
5. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
6. Control locations.
7. Computer jack locations.
8. Load circuit wiring.
9. Network wiring requirements.
10. Connections to other equipment and other Lutron equipment.
11. Installer responsibilities.
12. Power panel locations.

D. Sequencing:

1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Design Documents: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.

C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.

D. Shop Drawings:

1. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
2. Provide detailed sequence of operations describing system functions.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed locations and settings for lighting control system components.

G. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Owner's name and registered with manufacturer.

I. Software: One copy of software provided under this section.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications:

1. Company with not less than ten years of experience manufacturing lighting control systems of similar complexity to specified system.
2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Standard Warranty, With Manufacturer Start-Up; Lutron Standard 2-Year Warranty; Lutron LSC-B2:

1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:

a. First Two Years:

1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
2) First-available on-site or remote response time.
3) Remote diagnostics for applicable systems.

b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.

2. Lighting Management System Computer: One year 100 percent parts coverage, one year 100 percent manufacturer labor coverage.
3. Ballasts/Drivers and Ballast Modules: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Lutron Electronics Company, Inc; www.lutron.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of 10 working days prior to the bid date and must be

made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

2. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.

C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

A. Sensor Layout and Tuning: Include as part of the base bid additional costs for Lighting Control Manufacturer's Sensor Layout and Tuning service; Lutron LSC-SENS-LT:

1. Lighting Control Manufacturer to take full responsibility for wired or wireless sensor layout and performance for sensors provided by Lighting Control Manufacturer.

2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.

3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.

4. Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits, within one calendar year from Date of Substantial Completion to fine-tune sensor calibration per the agreed upon sequence of operations.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.

E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

F. Dimming and Switching (Relay) Equipment:

1. Designed so that electrolytic capacitors operate at least 36 degrees F (20 degrees C) below the capacitor's maximum temperature rating when the device is under fully loaded conditions at maximum rated temperature.

2. Inrush Tolerance:

a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times the rated operating current of the dimmer/relay.

b. Capable of withstanding repetitive inrush current of 50 times the operating current without impacting lifetime of the dimmer/relay.

3. Surge Tolerance:

a. Panels: Designed and tested to withstand surges of 6,000 V, 3,000 amps according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance.

b. Other Power Handling Devices: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.

4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.

5. Dimming Requirements:

a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage per cycle), frequency shifts (plus or minus 2 Hz change in frequency per second), dynamic harmonics, and line noise.

1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.

b. Incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.

c. Utilize air gap off to disconnect the load from line supply.

d. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.

e. Load Types:

1) Assign a load type to each dimmer that will provide a proper dimming curve for the specific light source to be controlled.
2) Provide capability of being field-configured to have load types assigned per circuit.

f. Minimum and Maximum Light Levels: User adjustable on a circuit-by-circuit basis.

g. Line Voltage Dimmers:

1) Dimmers for Magnetic Low Voltage (MLV) Transformers:
a) Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
b) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.

2) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.
3) Dimmers for Neon and Cold Cathode Transformers:
a) Magnetic Transformers: Listed for use with normal (low) power factor magnetic transformers.
b) Electronic Transformers: Must be supported by the ballast equipment manufacturer for control of specific ballasts being provided.

h. Low Voltage Dimming Modules:

1) Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to a single zone.

2) Single low voltage dimming module; capable of controlling the following light sources:
   a) 0-10V analog voltage signal.
      (1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
      (2) Sink current according to IEC 60929.
      (3) Source current.
   b) 10-0V reverse analog voltage signal.
   c) DSI digital communication.
   d) DALI broadcast communication per IEC 60929:
      (1) Logarithmic intensity values complying with IEC 60929.
      (2) Linear intensity values for use with LED color intensity control.
   e) PWM per IEC 60929.

6. Switching Requirements:
   a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
   b. Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

G. Device Finishes:

1. Wall Controls: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
2. Standard Colors: Comply with NEMA WD1 where applicable.
3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.3 FLUORESCENT ELECTRONIC DIMMING BALLASTS

A. General Requirements:

1. Designed for 10 year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Designed and tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
3. Lamp Starting Method: Programmed rapid start.
4. Maximum Inrush Current: 7 amperes for 120V ballasts and 3 amperes for 277V ballasts.
5. Current Crest Factor (CCF): Less than 1.7.
6. Comply with ANSI C82.11 and list and label as complying with UL 935.
7. Designed to not interfere with infrared devices operating at frequencies between 38 kHz and 42 kHz.
8. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
9. Inaudible in a 27 dBA ambient.

10. No visible change in light output with a variation of plus or minus 10 percent line voltage input.
11. Actively prevent overheating in T5-HO linear fluorescent lamp applications.
12. Ballasts to track evenly across multiple lamp lengths and all light levels.
13. Comply with IEC 61347-2-3 as applicable.

B. Digital Control:

1. Monitor and report lamp and ballast status.
2. Lights automatically return to the setting prior to power interruption.
3. Each ballast responds independently to:
   a. Up to 32 occupant sensors.
   b. Up to 64 personal control inputs.
   c. Two daylight sensors.
4. Unique internal reference number visibly displayed on ballast cover.
5. Averages two independent daylight harvesting inputs internally.
6. Responds to digital load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by three percent to 27 percent).

C. Product(s):

1. Digital Control, One Percent Dimming; Lutron EcoSystem H-Series:
   a. Dimming Range: 100 to less than one percent relative light output for T8, and one percent relative light output for T5 and T5HO lamps.
   b. Surge Tolerance: Designed and tested to withstand surges of 4,000 V according to IEEE C41.2 without impairment of performance.
   c. Total Harmonic Distortion (THD): Less than 10 percent.

2.4 LED DRIVERS

A. General Requirements:

1. Designed for 10 year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Designed and tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
3. Maximum Inrush Current: 2 amperes for 120V and 277V drivers.
4. UL 8750 recognized or listed as applicable.
5. Comply with IEC 61347-2-13 as applicable.
6. Surge Tolerance: Designed and tested to withstand surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
7. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
8. Class A sound rating; Inaudible in a 27 dBA ambient.

9. No visible change in light output with a variation of plus or minus 10 percent line voltage input.
10. Total Harmonic Distortion (THD): Less than 20 percent; comply with ANSI C82.11.
11. Drivers to track evenly across multiple lamp lengths and all light levels.
12. Constant Current Drivers:
    a. Support from 200 mA to 2.1 A (in 10 mA steps) to ensure a compatible driver exists.
    b. Support LED arrays up to 40W or 50 W (710 mA to 1.05 A in 10 mA steps).
    c. Constant Voltage Drivers:
    d. Support from 10 V to 40 V (in 0.5 V steps) to ensure a compatible driver exists.
    e. Support LED arrays up to 40W.
    f. Configuration tool available to optimize the following for LED fixtures:
    g. Light level.
    h. Efficacy.
    i. Thermal performance.

B. Digital Control:

1. Lights automatically return to the setting prior to power interruption.
2. Operate from input voltage of 120 V through 277 V at 60 Hz.
3. Each driver responds independently to:
    a. Up to 32 occupant sensors.
    b. Up to 16 daylight sensors.
4. Responds to digital load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by three percent to 27 percent).

2.5 POWER INTERFACES

A. Provide power interfaces as indicated or as required to control the loads as indicated.

B. General Requirements:

1. Phase independent of control input.
2. Rated for use in air-handling spaces as defined in UL 2043.
3. Utilize air gap off to disconnect the load from line supply.
4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

Product(s):

2.6 LIGHTING CONTROL MODULES (LUTRON ENERGI SAVR NODE)

A. Provide lighting control modules as indicated or as required to control the loads as indicated.

B. General Requirements:

1. Listed to UL 508 as industrial control equipment.

2. Delivered and installed as a listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.
5. Connection without interface to wired:
   a. Occupancy sensors.
   b. Daylight sensors.
   c. IR receivers for personal control.
6. Connects to lighting management hub via RS485.
7. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
8. Contact Closure Input:
   a. Directly accept contact closure input from a dry contact closure or sold-state output without interface to:
      1) Activate scenes.
         a) Scene activation from momentary or maintained closure.
      2) Enable or disable after hours.
         a) Automatic sweep to user-specified level after user-specified time has elapsed.
         b) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
         c) Occupant can reset timeout by interacting with the lighting system.
      3) Activate or deactivate demand response (load shed).
         a) Load shed event will reduce lighting load by user-specified amount.
9. Emergency Contact Closure Input:
   a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
   b. Allow configurable zone response during emergency state.
   c. Disable control operation until emergency signal is cleared.
10. Supplies power for control link for keypads and control interfaces.
11. Distributes sensor data among multiple lighting control modules.
12. Capable of being controlled via wireless sensors and controls.

C. Switching Lighting Control Modules:

1. Product(s):
   a. Lutron SoftSwitch Energi Savr Node; Model QSN-4S20-S. 20 A (16 A ballast) continuous-use per channel; able to switch 20A receptacles.
2. Switching:
   a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
   b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

d. Module to integrate up to four individually controlled zones.

e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

D. Digital Fixture Lighting Control Modules:

1. Product(s):

a. Lutron EcoSystem Energi Savr Node; Model QSN-2ECO-S: Two EcoSystem Digital Links.

2. Provides two-way feedback with digital fixtures for energy monitoring, light level status, lamp failure reporting, and ballast/driver failure reporting.

3. Provide testing capability using manual override buttons.

4. Each low-voltage digital communication link to support up to 64 ballasts or LED drivers capable of NFPA 70 Class 1 or Class 2 installation.

E. Total Light Management Control Module (Digital Lighting and Shades Control):

1. Product: Lutron EcoSystem with Shades Energi Savr Node; Model QSN-2ECO-PS120 - Two EcoSystem Digital Links.

2. Ten fused 30W (60W peak) 24V DC outputs provide power to compatible shades, drapery drive units, keypads, and accessories.

3. Provide power for 10 to 30 shades dependent on shade dimensions.

4. Provide smart diagnostics for system verification.

5. Provide testing capability using manual override buttons.

6. Each low-voltage digital communication link to support up to 64 ballasts capable of NFPA 70 Class 1 or Class 2 installation.

2.7 DIGITAL DIMMING BALLAST AND SWITCHING MODULES (LUTRON ECOSYSTEM)

A. Provide digital dimming ballast and switching modules as indicated or as required to control the loads as indicated.

B. General Requirements:

1. Provide continuous 3-wire signal dimming to compatible 3-wire electronic dimming ballasts.

2. Utilize air gap off to disconnect the load from line supply.

3. Connect without interface to:

a. Occupancy sensor.

b. Daylight sensor.

c. Personal control input (wall station or infrared receiver).

4. Generate digital communication commands to distribute ballast and sensor data on the digital bus.

5. If power is interrupted and subsequently restored, lights automatically return to the setting prior to power interruption.

6. Each ballast module responds independently to:

a. Up to 32 occupancy sensors.

b. Up to 64 personal control inputs.

c. Two daylight sensors.

7. Unique internal reference number visible displayed on module cover.

8. Averages two independent daylight harvesting inputs internally.

9. Responds to digital load shed command.

a. Sets high end trim.

b. Automatically scales light output proportional to load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast to automatically set the maximum light output at 90 percent and lower current light output by 3 percent to 27 percent).

10. Provide integral fault protection to prevent ballast module failure in the event of a mis-wire.

C. Product(s):

2.8 LIGHTING MANAGEMENT HUBS

A. Product: Lutron Quantum Light Management Hub.

B. Provided in a pre-assembled NEMA listed enclosure with terminal blocks listed for field wiring.

C. Connects to controls and power panels via RS485.

D. Enables light management software to control and monitor compatible dimming ballasts and ballast modules, power panels, power modules, and window treatments.

1. Utilizes Ethernet connectivity to light management computer utilizing one of the following methods:

a. Dedicated network.

b. Dedicated VLAN.

c. Shared network with Building Management System (BMS).

d. Corporate network where managed switches are configured to allow multicasting and use of IGMP.

E. Integrates control station devices, power panels, shades, preset lighting controls, and external inputs into a single customizable lighting control system with:

1. Multiple Failsafe Mechanisms:

a. Power failure detection via emergency lighting interface.

b. Protection: Lights go to full on if ballast wires are shorted.

c. Distributed architecture provides fault containment. Single hub failure or loss of power does not compromise lights and shades connected to other lighting management hubs.

2. Manual overrides.

3. Automatic control.

4. Central computer control and monitoring.

F. Furnished with astronomical time clock.

G. Maintains a backup of the programming in a non-volatile memory capable of lasting more than ten years without power.

2.9 LIGHTING MANAGEMENT SYSTEM SOFTWARE

A. Provide system software license and hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Configuration Setup Software:

1. Product: Lutron Q-Design.
2. Suitable to make system programming and configuration changes.
3. Windows-based, capable of running on either central server or a remote client over TCP/IP connection.
4. Allows manufacturer (either remotely or with on-site service call) or end-user (with training) to:
   a. Capture system design:
      1) Geographical layout.
      2) Load schedule zoning.
      3) Equipment schedule.
      4) Equipment assignment to lighting management hubs.
      5) Daylighting design.
   b. Define the configuration for the following in each area:
      1) Lighting scenes.
      2) Control station devices.
      3) Interface and integration equipment.
      4) Occupancy/after hours.
      5) Partitioning.
      6) Daylighting.
      7) Emergency lighting.
      8) Night lights.
   c. Startup:
      1) Addressing.
      2) Daylighting.
      3) Provide customized conditional programming.

C. Control and Monitor Software:

1. Product: Lutron Q-Admin.
2. Basic System View: The system navigation and status reporting is performed using a tree view of the building.
3. Control of Lights:
   a. Area lights can be monitored for on/off status.
   b. All lights in an area can be turned on/off or sent to a specific level.
   c. For areas that have been zoned, these areas may be sent to a predefined lighting scene, and individual zones may be controlled.
   d. Area lighting scenes can be modified in real-time, changing the levels that zones go to when a scene is activated.

e. High and low end of area lighting can be tuned/trimmed.

f. Control and monitor area partition status.

4. Occupancy:

a. Area occupancy can be monitored.

b. Area occupancy can be disabled to override occupancy control or in case of occupancy sensor problems.

c. Area occupancy settings including level that lights turn on to when area is occupied, and level that lights turn off to when area is unoccupied can be changed in real-time.

5. Daylighting:

a. Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.

b. Daylight target levels can be changed for each daylit area.

c. Daylight status can be monitored.

6. Load Shedding; Lutron IntelliDemand: Allows the building manager to monitor whole building lighting power usage and apply a customized load shed reduction to selected areas, thereby reducing a building's power usage; load shedding triggered via Quantum software, BACnet, or OpenADR.

7. Scheduling: Schedule time of day and astronomic time clock events to automate functions.

8. Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:

a. Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas or meter groups.

b. Power Reports: Show power usage trend over a period of time for one or more areas or meter groups.

c. Activity Report: Show what activity has taken place over a period of time for one or more areas. Activity includes occupant activities (e.g. wall controls being pressed), building manager operation (e.g. controlling/changing areas using the control and monitor tool), and device failures (e.g. keypads or ballasts that are not responding).

d. Lamp Failure Report: Shows which areas are currently reporting lamp failures.

e. Sensor Level Report: Shows the light level in footcandles of any photosensor in the system.

f. Alert Activity Report: Capable of generating historical reports of all alert activity within the system.

9. Diagnostics: Allows the building manager to check on the status of all equipment in the lighting control system. Devices to be listed with a reporting status of OK, missing, or unknown.

10. Alerts and Alarms: Monitors the system for designated events/triggers and automatically generates alerts according to configured response criteria.

a. Capable of monitoring for the following events/triggers:

1) A failed piece of equipment (e.g. ballast, control, sensor, etc.); alert cleared when equipment is replaced.
2) A lamp outage (for compatible EcoSystem digital electronic dimming ballasts only); alert cleared when lamp is replaced.

3) Low battery conditions in battery-operated sensors and controls; alert cleared when battery is replaced.
4) Luminaires with lamp operating hours in excess of designated time.
5) A load shed event; alert generated for beginning and end of trigger.
6) Energy usage higher than designated threshold target.
7) Potential light level condition discrepancies (daylight sensors not agreeing with expected lighting status).

b. Capable of generating alerts through visible changes in software or through email messages.

c. Capable of customizing the frequency of alerts and providing notifications immediately or through daily, weekly, or monthly summaries.

d. Capable of sending different alerts to different system users.

e. Capable of generating historical reports of all alert activity within the system.

11. Administration:

a. Users: Allows new user accounts to be created and existing user accounts to be edited.

1) Supports Active Directory (LDAP) tying user accounts to network accounts.

b. Area and feature access can be restricted based on login credentials with three levels of access rights (Admin, Programmer, Controller) and customized access levels available.

c. Publish Graphical Floor Plan: Allows admin user to publish new graphical floor plan files, allowing users to monitor the status of lights, occupancy of areas, and daylighting status.

d. Back-Up Project Database: Allows admin user to back up the project database that holds all the configuration information for the system, including keypad programming, areas scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.

e. Publish Project Database: Allows admin user to send a new project database to the server and download the new configuration to the system. The project database holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.

12. Virtual Global Buttons: Provide global scene control or modes of operation across entire system.

13. Provides control/monitoring of partition status to automatically reconfigure how the space operates based on the partition's open/closed status.

2.10 CONTROL STATIONS

A. Provide control stations with configuration as indicated or as required to control the loads as indicated.

B. Wired Control Stations:

1. General Requirements:

a. Class 2 (low voltage).

b. UL listed.

c. Control stations can be replaced without reprogramming.

2. Product(s):

a. Multi-Scene Wired Control:

1) Product(s):
a) Lutron seeTouch QS.

2) Allows control of any devices part of the lighting control system.
3) Utilize RS485 wiring for low-voltage communication.
4) Functionality:
a) Upon button press, LEDs to immediately illuminate.

b) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.

c) Allows for easy reprogramming without replacing unit.

d) Replacement of units does not require reprogramming.

5) Provide faceplates with concealed mounting hardware.
6) Engrave wall stations with button, zone, and scene descriptions as indicated on the drawings.
7) Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
8) Software Configuration:
a) Customizable control station device button functionality:

(1) Buttons can be programmed to perform single defined action.
(2) Buttons can be programmed to perform defined action on press and defined action on release.
(3) Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.

9) Control station device LEDs to support logic that defines when it is illuminated:
a) Scene logic (logic is true when all zones are at defined levels).

b) Room logic (logic is true when at least one zone is on).

c) Pathway (logic is true when at least one zone is on).

d) Last scene (logic is true when spaces are in defined scenes).

10) Contact Closure Interface: Accepts both momentary and maintained contact closures.

2.11 LOW-VOLTAGE CONTROL INTERFACES

A. Provide low-voltage control interfaces as indicated or as required to control the loads as indicated.

B. UL listed.

2.12 WIRED SENSORS

A. Wired Occupancy Sensors:

1. General Requirements:

a. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.

b. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.

c. Accommodates all conditions of space utilization and all irregular work hours and habits.

d. Comply with UL 94.

e. Self-Adaptive: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space.

f. Furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.

g. Provide capability to:

1) Add additional timeout system-wide without need to make local adjustment on sensor.
2) Group multiple sensors.

h. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.

i. Furnished with all necessary mounting hardware and instructions.

j. Class 2 devices.

k. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.

l. Wall-Mounted Sensors: Provide swivel-mount base.

m. Color: White.

2. Wired Dual Technology Sensors:

a. Passive Infrared: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.

b. Ultrasonic: Utilize an operating frequency of 32kHz or 40kHz, crystal-controlled to operate within plus/minus 0.005 percent tolerance.

c. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.

d. Isolated Relay: Provide an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options where indicated.

e. Integral Photocell: Provide an integral photocell with adjustable sensitivity to prevent lights from turning on when there is sufficient natural light where indicated.

f. Product(s), With Isolated Relay and Integral Photocell:

1) Type _____ - Ceiling-Mounted Dual Technology Sensor, 2000 square feet (186 sq m); Lutron Model LOS-CDT-2000R-WH: Coverage of 2000 square feet (186 sq m) with ceiling height of 8 to 12 feet (2.6 to 3.7 m); 360 degree field of view; with isolated relay and integral photocell.
2) Type _____ - Wall-Mounted Dual Technology Sensor; Lutron Model LOS-WDT-R-WH: Coverage of 1600 square feet (149 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 110 degree field of view; with isolated relay and integral photocell.

B. Sensor Power Packs:

1. Provide sensor power packs where required for power connection to sensors.

2. For ease of mounting, installation and future service, power pack(s) to be able to mount through a 1/2 inch knockout in a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer to provide power to a minimum of three sensors.
3. Plenum-rated.
4. Control Wiring Between Sensors and Control Units: Class 2, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

C. Wired Daylight Sensors:

1. Digital Interior Daylight Sensor:
   a. Product: Lutron Model EC-DIR-WH.
   b. Use Class 2 wiring for low voltage communication.
   c. Can be replaced without reprogramming.
   d. Open-loop basis for daylight sensor control scheme.
   e. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
   f. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
   g. Provide linear response from 0 to 500 footcandles.
   h. Integral IR receiver for personal control.
   i. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
   j. Constructed via sonic welding.
   k. Color: White.
2. Daylight Control Package:
   a. Product: Lutron CES Series (Lutron CES Analog Sensor, LC8 Controller, and Power Pack)
   b. Controller:
      1) Product: Lutron Model LC8.
      2) Automatically switches a dry contact according to changes in ambient light levels.
      3) Fully adjustable separate high and low setpoints, with an adjustable dead band between set points to prevent unwanted cycling.
      4) Input time delay to prevent unwanted cycling due to intermittent light level fluctuations.
      5) Signal/setpoint and relay status indication.
      6) Sensor calibration input.
   c. Sensors:
      1) Class 2, three-wire analog devices.
      2) Provision for zero or offset based signal.
      3) Indoor Photo Sensors; Lutron Model CES/I: With fresnel lens and 60 degree cone of response; sensor range of 0 to 750 footcandles.

PART 3 EXECUTION

3.1 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, except for mounting heights specified in those standards.

B. Install products in accordance with manufacturer's instructions.

C. Define each dimmer/relay load type, assign each load to a zone, and set control functions.

D. Sensor Locations:

1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.

2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.

E. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

F. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

G. Lamp Lead Lengths: Do not exceed 3 feet (0.9 m) for T4 4-pin compact and T5 BIAX lamps and 7 feet (2.1 m) for T5, T5-HO, T8 U-bend, and T8 linear fluorescent lamps.

H. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

I. Identify system components in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Manufacturer's Startup Services; Lutron Standard Startup Services:

1. Manufacturer's authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.

2. Conduct Pre-Installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".

3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:

a. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.

b. Verify connection of power wiring and load circuits.

c. Verify connection and location of controls.

d. Energize lighting management hubs and download system data program.

e. Address devices.

f. Verify proper connection of panel links (low voltage/data) and address panel.

g. Verify system operation control by control.

h. Verify proper operation of manufacturer's interfacing equipment.

i. Verify proper operation of manufacturer's supplied PC and installed programs.

j. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.

k. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".

l. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".

m. Obtain sign-off on system functions.

4. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.3 ADJUSTING

A. Sensor Fine-Tuning: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits for fine-tuning of sensor calibration. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, Contractor to provide fine-tuning of sensor calibration.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 COMMISSIONING

A. See Section 01 91 13 for commissioning requirements.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration:

1. On-Site Performance-Verification Walkthrough; Lutron LSC-WALK: Include as part of the base bid additional costs for lighting control manufacturer to provide on-site demonstration of system functionality to commissioning agent.

D. Training:

1. Include services of manufacturer's authorized Service Representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.
    a. Include training on software to be provided:
        1) Configuration software used to make system programming and configuration changes.
        2) Control and monitor.
2. Customer-Site Solution Training Visit; Lutron LSC-TRAINING: Include as part of the base bid additional costs for Lighting Control Manufacturer to provide one day(s) of additional on-site system training.

**END OF SECTION**

# SECTION 26 20 00 - SERVICE AND DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding.
2. Distribution panelboards.
3. Overcurrent protection devices.
4. Photoelectric switches.

1.2 SYSTEM DESCRIPTION

A. Electrical Service System: 208Y/120 and 480Y/277 volts, 3 phase, 4 wire, and wye. Refer to One Line Diagram for further requirements.

1. Grounding: Provide grounding and bonding of electrical service, circuits, equipment, signal and communications systems.
2. Building Ground Electrode: Coordinate placement of ground rods and grounding electrode conductor in base of building footing prior to placement
3. Performance Requirements: Supplement the grounded neutral of the secondary distribution system with an equipment grounding system to properly safeguard the equipment and personnel. Install equipment grounding such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

A. Provide Shop Drawings and Product Data for the Following Equipment:

1. Grounding.
2. Distribution panelboards.
3. Overcurrent protection devices.

B. Provide operating and maintenance instructions from the manufacturer for project closeout, see Project Closeout Requirements in Division 1.

1. Distribution panelboards.
2. Overcurrent protection devices.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.

B. Furnish products listed by UL or other testing firm acceptable to AHJ.

C. Conform to the requirement of the serving electric utility.

PART 2 PRODUCTS

2.1 GROUNDING MATERIALS

A. Ground Rods: Copperclad steel, 3/4-inch diameter, 20 feet long, tapered point, chamfered top. Manufacturers: Weaver, Thomas & Betts, Talley or approved.

B. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors. Mechanical type of connectors is not acceptable. Manufacturers: Burndy Hyground Compression System, Erico/Cadweld, Amp Ampact Grounding System or approved.

C. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe. Burndy GAR Series, O-Z Gedney, Thomas & Betts or approved.

D. Telecommunications Grounding Bar: 1/4-inch thick by 4-inch high by 20-inch long copper ground bar with insulators. Manufacturers: Erico/Cadweld or approved.

E. Grounding Electrode Conductor: Bare copper stranded conductor.

2.2 DISTRIBUTION PANELBOARDS

A. Approved manufacturers: Square D Electrical, General Electric, Siemens or Eaton.

B. Standards: Comply with requirements of UL 67 and NEMA PB1 in construction of switchboards. Provide short circuit current rating (Integrated Equipment Rating, IER) for panelboards. Furnish panelboards with UL label.

C. Enclosure: Surface or flush panelboards as shown on the plans. Provide galvanized metal finish.

D. Bussing: Copper bar with suitable electroplating (tin) for corrosion control at connection. Provide ground bar to accommodate specified terminal lugs. Predrill bus for bolt-on type circuit breakers.

E. Provide fully rated integrated equipment rating greater than the available fault current. See Drawings for available fault current. Minimum interrupt rating is 10,000 amps.

F. Lugs: Compression type rated for both aluminum and copper conductors.

G. Breakers: Bolt-on type.

H. Cover: Hinged door with door-in-door construction, flush lift latch and lock, two keys per panel. Key all branch circuit panelboards alike. Coordinate keying with owner. Medium light gray finish suitable for field painting to match wall finish. Surface panels to have metal trim covers with no sharp edges or corners.

I. Where panels are mounted in finished interior areas in normal view of the building occupants, paint covers to match adjacent wall surface.

J. Integral Transient Voltage Surge Suppressor (TVSS):

1. Panelboard: UL 67 Listed and provide the TVSS device with UL 1449, second edition, component listing. Panelboard markings shall include clamp voltage at the TVSS terminals as well as clamp voltage at the panelboard line terminals.

2. Suppressors: Independently tested with the Category-C3 high exposure waveform (20KV - 1.2/50 µs, 10 kA - 8/20 µs) per ANSI/IEEE C62.41 - 1991.

3. Provide copper bus bars for the surge current path. Do not use small round wiring or plug-in connections in the path of surge current diversion.

4. Construct TVSS using surge current modules (MOV based). Fuse each module with user replaceable 200,000 AIR rated fuses. Monitor the status of each module on the front cover of the panelboard enclosure as well as on the module.

5. Provide an audible alarm which shall activate when one of the surge current modules has failed. Provide an alarm on/off switch to silence the alarm and an alarm push-to-test switch to test the alarm. Locate the switches and alarm on the front cover of the panelboard enclosure.

6. Meet or exceed the following criteria:

   a. Maximum Single Impulse Current Rating: No less than 120kA per phase.

   b. Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category-C transients without failure or degradation.

   c. The Clamping Voltage shall not Exceed the Following:

| VOLTAGE | L-N | N-G | L-G |
|---|---|---|---|
| 208Y/120 | 500V | 500V | 500V |
| 480Y/277 | 1000V | 1000V | 1000V |

7. Provide a response time no greater than 5 nanoseconds for any of the individual protection modes.

8. Design suppressors to withstand a maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.

9. Provide visible indication of proper suppressor connection and operation. The indicator lights shall indicate which phase as well as which module is fully operable.

10. Provide a minimum EFI/RFI filtering of 34 B at 100KHZ with an insertion loss ratio of 50:1 using Military Standard 220A methodology.

11. Provide a 5 year warranty, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

12. Provide one circuit breaker sized per manufacturer's recommendations, with the appropriate number of poles as a dedicated disconnect for the TVSS.

K. When indicated on Drawings, provide 200 percent rated copper neutral assembly.

2.3 OVERCURRENT PROTECTION DEVICES

A. Fusible Switches:

1. Provide fusible switches quick-make, quick-break with fuse rejection feature for Class J fuses up to 600 amp and group-mounted in panel-type construction.

2. Provide switches of 30 to 200 amp with plug-on line side connections.

3. Provide each switch enclosed in a separate steel enclosure. The enclosure will employ a hinged cover for access to the fuses which will be interlocked with the operating handle to prevent opening the cover when the switch is in the "ON" position. Construct this interlock so that it can be released with a standard electrician's tool for testing fuses without interrupting service.

4. Provide the units with padlocking provisions in the "OFF" position and the operating handle position giving positive switch position indication, i.e. red for "ON," black for "OFF."

5. Provide switches which pass industry standard I2t withstandability tests and fuse tests suitable for use as service equipment.

B. Fuses: Dual element, time delay, current limiting, nonrenewable type, rejection feature. UL Class J, 1/10 to 600 amp, UL Class L, above 600 amps. Provide fuse pullers for complete range of fuses. Manufacturers: Bussmann, Ferraz-Shawmut, Littelfuse, or approved.

C. Molded Case Circuit Breakers:

1. 1-, 2-, or 3-pole bolt-on, single-handle common trip, 600VAC or 250VAC as indicated on Drawings.

2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

3. Calibrate for operation in 40C ambient temperature.

4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

6. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions. Provide ground fault function for breakers greater than 400 amps.

7. Provide all circuit breakers series rated when series combination ratings are applied, identify all equipment enclosures.

8. Manufacturers: Eaton Electrical, General Electric, Siemens or Square D.

2.4 FUSE CABINET

A. Provide metallic cabinet surface-mounted, with internal shelves, trim cover with hinged and latched door. Size cabinet such that spare fuses required by these Documents do not exceed 50 percent of cabinet volume. Provide engraved label to identify as Spare Fuse Cabinet. Locate in multipurpose janitors closet.

B. Manufacturers: Bussmann, Circle AW, Ferraz-Shawmut, Littelfuse, Siemens, or approved.

PART 3 EXECUTION

3.1 INSTALLATION

A. Concrete Encased Ground Electrode:

1. From the service equipment ground bus install grounding electrode conductor to footing foundation rebar.

2. Bond the grounding electrode conductor to three independent steel rebars. Each rebar's minimum length is 20 feet.

3. Protect grounding electrode conductor extension from footing/foundation to service equipment with rigid PVC conduit. Do not use metal conduit for grounding electrode conductor protection.

B. Ground Rod Electrode:

1. Coordinate placement of ground rods and interconnecting conductor in base of building concrete footing prior to placement of concrete.

2. Install 40 feet of No. 3/0 stranded bare copper conductor in base of perimeter concrete footing.

3. Lay out conductor to provide maximum exposure to earth in the perimeter footing. Do not fold conductor.

4. Bond to driven ground rods at 20 feet o.c.

5. Tap at center ground rod and extend ground electrode conductor to service ground bus. Install ground electrode conductor extension in rigid PVC conduit for physical protection.

C. Water Service Grounding: Bond building ground electrode and water service pipe to service ground bus. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

D. Other Piping Systems: Bond gas piping system, fire sprinkler piping system and other metallic piping systems.

E. Raceway Grounding:

1. Ground all metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger grounding conductor is included with circuit, use grounding bushing with lay-in lug.

2. Connect all metal raceways, which terminate within an enclosure but without mechanical connection to the enclosure, by grounding bushings and ground wire to the grounding bus.

3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.

4. Install equipment grounding conductor, code size minimum unless noted on Drawings, in all raceway systems.

F. Feeders and Branch Circuits Grounding:

1. Install continuous insulated equipment copper ground conductors within the following circuits; feeders, circuits for computer systems and other circuits as indicated on Drawings.

2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment ground conductors for feeders and branch circuits sized in accordance with Table 250-122.

G. Boxes, Cabinets, Enclosures and Panelboards Grounding: Bond grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

H. Motors, Equipment and Appliance Grounding: Install code size equipment grounding conductor from outlet box to (motor) equipment frame or manufacturer's designated ground terminal.

I. Receptacle Grounding: Connect ground terminal of receptacle to equipment ground system by No. 12 conductor bolted to outlet box except isolated grounds where noted. Self grounding nature of receptacle devices does not eliminate conductor bolted to outlet box.

J. Telecommunications Backboard: Provide telecommunications grounding bar at each telecommunications backboard. Bond the grounding bar to service grounding bar in the main service equipment of each building with a 6AWG copper equipment grounding conductor.

K. Separately Derived Systems: Ground each separately derived system.

L. Distribution Panelboards:

1. Install equipment as directed by manufacturer's installation instructions.

2. Install distribution panelboards surface or flush-mounted in accessible locations as indicated on Drawings. Maintain or exceed minimum clearances required by code.

3. Install equipment in conformance with work space requirements of CEC. Locate equipment in rooms or spaces dedicated to such equipment. Coordinate with other Divisions of work.

4. Equipment arrangement in electrical room is based on one manufacturer. Coordinate space requirements with equipment supplier. Maintain code required and manufacturer's clearances.

5. Where flush panels are installed, verify available recessing depth and coordinate wall framing with other Divisions.

6. Feeder conductors to enter directly in line with lug terminals wherever practicable. Feeder conductors, except ground and neutral, not to exceed 45 degree deflection from raceway entry to feeder phase lugs.

7. Paint panel cover and surface-mounted enclosure (if surface allowed) to match finished wall color where panels are located in finished spaces.

8. Where panels are installed flush, provide 3 1-inch spare conduits from panel to accessible space above.

9. Where panels are installed flush in fire rated walls, maintain fire rating of wall.

10. Cable and tree conductors in panelboards with plastic ties.

11. Provision for Future: Where provision for "future" or "space" is noted on Drawings, equip the space with bus connections to the future overcurrent device with suitable insulation and bracing to maintain proper short circuit rating and physical clearance. Provide buses for the ampere rating as shown for the future device.

    a. Overcurrent Protection Devices:

12. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:

    a. 1 to 24: Provide 6 spare.
    b. 25 to 48: Provide 9 spare.
    c. 49 and Above: Provide 12 spare.

13. Provide testing of ground fault interrupting breakers.

M. Control Devices:

1. Install photoelectric control devices at such locations as necessary to be most effective. Avoid locating photoelectric devices in or at locations where they can be influenced by other than natural light or under eaves. Verify location of equipment with Architect.

3.2 CLEANING

A. Thoroughly clean the exterior and the interior of each switchboard and distribution panelboard in accordance with manufacturer's installation instructions.

B. Vacuum construction dust, dirt and debris out of each switchboard and distribution panelboard.

C. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

3.3 TESTING

A. Refer to Section 26 08 00 for Testing procedures and requirements.

END OF SECTION

# SECTION 26 22 00 - DRY TYPE TRANSFORMERS
## Replaces 26 05 33

PART 1 GENERAL

1.1 WORK INCLUDED

A. Dry type ventilated two winding transformers with primary and secondary voltages of 600 Volts and less, and capacity ratings up to 750 kVA.

1.2 REFERENCES

A. NEMA ST20 - Dry Type Transformers for General Applications.

B. NEMA TP-1, Guide for Determining Energy Efficiency for Distribution Transformers.

C. NEMA TP-2, Standard Test Method for Measuring the Energy Consumption of Distribution Transformers.

D. NEMA TP-3, Standard for the Labeling of Distribution Transformer Efficiency.

E. UL 1561.

F. Manufacturer's shall be registered in accordance with ISO 9002: 1994 SIC 3612 (US).

1.3 SUBMITTALS

A. Submit manufacturer's product and specification sheets to include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 35, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

B. Submit per Section 26 00 00.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

B. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D, Westinghouse/Cutler Hammer, or General Electric.

2.2 DRY TYPE TWO WINDING TRANSFORMERS

A. Transformers of the size and type required shall have energy efficiencies that meet or exceed the latest requirements of the California Code of Regulations Title 20 and Title 24, and NEMA TP-1 for optimum efficiency at 35% load. Transformers shall be "Energy Star" labeled.

Transformers shall be factory assembled, ventilated air cooled dry type, ratings as shown on the Drawings.

B. Insulation system and average winding temperature rise for rated KVA as follows:

| Rating | Insulation (Degree C) | Rise Above 40° Ambient (Degree C) |
|---|---|---|
| 3-15 | 185 | 115 |
| 15-500 | 220 | 150 |

C. Case temperature shall not exceed 50 degrees C rise above ambient at its warmest point.

D. Winding Taps: Full capacity primary taps with (2) 2.5% Above and below rated voltage.

E. Sound Levels: Maximum sound levels shall be as follows:

| KVA Rating | Sound Level |
|---|---|
| 1-9 | 40 dB |
| 15-50 | 45 dB |
| 51-150 | 50 dB |
| 151-300 | 55 dB |
| 300-500 | 60 dB |
| 750 | 64 dB |

F. Basic Impulse Level: 10 kV.

G. Transformer impedances shall have a minimum nominal value as noted below. Minimum value indicated takes into account a 7.5% tolerance. Transformers rated 150 kVA and lower with a 120/208 Volt secondary shall have a minimum impedance level so as not to exceed a 10,000 short circuit let-thru based on a unlimited source.

500 kVA: 5.0% (minimum 4.7%)
300 kVA: 5.0% (minimum 4.7%)
225 kVA: 5.0% (minimum 4.7%)
150 kVA: 4.5% (minimum 4.2%)
112 kVA: 3.4% (minimum 3.2%)
75 kVA and lower: 2.3% (minimum 2.1%)

H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

I. Mounting: Transformers 30 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 30 KVA shall be suitable for floor or trapeze mounting.

J. Coil Conductors: Continuous windings with termination brazed or welded.

K. Enclosure: ANSI/NEMA ST 20; Type 3R with weathershield and rodent screen at outdoor locations.

L. Isolate core and coil from enclosure using vibration-absorbing mounts.

M. Nameplate: Include transformer connection data. Label per section 26 00 00 with engraved laminated plastic labels secured with screws, "TRANSFORMER-XXX FED BY PANEL-YYY".

N. K-Rated Transformers (Where indicated on the drawings).

1. Minimum "K" rating of 9. Where this does not constitute a standard size, the next higher size shall be used.

2. Transformer shall incorporate an electrostatic shield grounded to the transformer core.

3. Impedance range, 3% minimum to 5% maximum.

4. Neutral bus shall be sized for a minimum of 200% of rated secondary current.

5. Coils shall be continuous wound construction.

6. Cores shall be copper, common core construction having low hysterisis and eddy current losses. The core flux density shall be below the saturation point to prevent overheating caused by harmonic distortion.

2.3 SECONDARY BREAKER

A. Provide a single secondary main breaker within 10 conductor feet of the transformer in a NEMA-1 (NEMA-3R for outdoor and wet/damp locations) enclosure. The secondary breaker may be installed in the loadside panel the transformer is feeding if the distance limitation is met.

PART 3 EXECUTION

3.1 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, 2 ft. (0.6M) minimum length, for connections to transformer case.

C. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure. Provide seismic restraints as needed. Provide and install on reinforced concrete pad for outdoor ground level installations.

D. Transformers installed outdoors shall be listed for outdoor use. The use of a weathershield shall be acceptable.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.3 WARRANTY

A. All materials and installation shall be provided with a one (1) year warranty which shall include replacement parts, labor, retesting, and travel to and from the job site. The warranty period shall begin after final acceptance of the project.

END OF SECTION

# SECTION 26 50 00 - LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaires and lampholders.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

1.2 SUBMITTALS

A. Submit for:

1. Luminaires: Include electrical ratings, dimensions, mounting, material, required clearances, terminations, wiring and connection diagrams, photometric data, diffusers, and louvers.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

B. Provide the following operating and maintenance instructions from the manufacturer for project closeout, see Project Closeout Requirements in Division 1:

1. Luminaires.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Provide luminaires acceptable to code authority for application and location as indicated.
2. Comply with applicable ANSI standards pertaining to lamp materials, lamp ballasts and transformers, and luminaires.
3. Comply with applicable NEMA standards pertaining to lighting equipment.
4. Provide luminaires and lampholders which comply with UL standards and have been UL listed and labeled for location and use indicated.
5. Comply with CEC as applicable to installation and construction of luminaires.

6. Comply with fallout and retention requirements of IBC for diffusers, baffles, louvers, and the like.

1.4 WARRANTY

A. Ballast Manufacturer's Warranty: Not less than 2 years for magnetic type ballasts and 5 years for electronic type ballasts, based on date of manufacturer embossed on ballast, current with installation date. Warranty includes normal cost of labor for replacement of ballast.

B. Lamp Warranty: 30 days for incandescent, 6 months for compact fluorescent, 12 months for fluorescent and HID lamps.

1.5 MAINTENANCE

A. Furnish 2 percent extra lens or louvers for each size and type of fluorescent luminaire.

B. Furnish 10 percent extra lamps for each size and type installed.

C. Furnish 5 percent extra ballasts for each size and type.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Luminaires: Refer to description and manufacturers in Luminaire schedule.

B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.

C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet locations.

D. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper trim, frame and modify luminaire to fit location and ceiling material.

E. Finishes:

1. Manufacturer's standard finish (unless otherwise indicated) over a corrosion resistant primer.

2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectances.

3. Exterior Finishes: As detailed in luminaire schedule or on Drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

F. Light Transmitting Components:

1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.

2. Prismatic acrylic, extruded, flat diffusers, 0.125 inch overall thickness, unless otherwise noted.

G. Fluorescent Luminaires:

1. Provide all open lamp fluorescent luminaires without diffusers or guards with turret type, spring loaded sockets.

2. To facilitate multilevel lamp switching, wire lamps within luminaire with outermost lamp at both sides of luminaire on the same ballast, the next inward pair on another ballast and so on to innermost lamp (or pair of lamps).

3. Provide wire lamp guards on all exposed lamp fluorescent luminaires.

2.2 BALLASTS

A. General:

1. Provide ballasts UL rated for specified lamps.

2. Thermal Protection: Internal UL Class 'P' with automatic reset.

3. Sound Ratings: Class 'A'. Where not available as standard product from any specified manufacturer, provide quietest rating available.

4. Total Harmonic Distortion: Not to exceed 10 percent of the input current unless otherwise indicated.

5. Input Voltage: Match branch circuit supply voltage; refer to Drawings.

6. Provide quantity of ballasts to provide switching as indicated on Drawings.

7. Provide factory printed wiring diagram on ballast housing.

8. Ballasts used in enclosed and gasketed luminaires shall be of Type 1 construction.

9. Comply with FCC rules and regulations Part 18, Class A concerning generation of both electromagnetic interference and radio frequency interference.

10. Provide 3-year warranty against defects in materials and workmanship, including either a USD 10 replacement labor allowance or complete replacement including labor by an agent of the manufacturer.

B. Ballasts for Linear Fluorescent Lamps:

1. Power Factor: Minimum 97 percent.

2. To operate a maximum of three lamps. Do not provide four lamp ballasts.

3. Nondimming Electronic:

a. Tandem wiring between luminaires may be used to minimize the number of ballasts while accomplishing the switching requirements shown on Drawings. Provide label in lamp compartment of luminaire to identify the function of ballast. Label shall not be visible from room.
b. Provide ballasts that meet requirements of UL 935, ANSI C82.11 and bear the appropriate UL label.
c. Provide ballasts that withstand input power line transients as defined in ANSI C62.41, Category-A and IEEE 587.
d. Parallel wired, instant start circuitry.
e. High frequency operation: Not less than 42kHz.

f. Lamp Crest Factor: Maximum 1.7 for programmed rapid start ballasts and maximum 1.85 or less for instant start ballasts.
g. Average Ballast Factor (BF): Minimum 88 percent or as indicated in the luminaire schedule.
h. Provide 0 degree Fahrenheit minimum starting temperature for luminaires installed where exposed to anticipated ambient temperature less than 55F.
i. Manufacturer: Advance, Universal Lighting Technologies, OSRAM/Sylvania, or approved.

4. Dimming Electronic:

a. Shall meet all requirements of nondimming electronic ballasts.
b. Do not use tandem wiring between luminaires.
c. Ballast shall start lamp at any preset light output setting and provide continuous, square law dimming from 100 percent to specified low-end output.
d. 10 Percent Dimming: Control protocol shall be line voltage type with positive line voltage On/Off. Manufacturer: Lutron ECO-10, Advance MarkX, or approved.

C. Ballasts for Compact Fluorescent Lamps:

1. Power Factor: Minimum 97 percent.

2. Do not use tandem wiring between luminaires.

3. Provide ballasts which meet requirements of UL 935, ANSI C82.11 and bear the appropriate UL label.

4. With integral end of lamp life detection and shutdown circuit with automatic reset.

5. Nondimming Electronic:

a. Series wired, programmed rapid start circuitry.
b. High frequency operation: Not less than 50kHz.
c. Lamp Crest Factor: Maximum 1.5.
d. Average Ballast Factor (BF): Minimum 98 percent.
e. 0 degree Fahrenheit minimum starting temperature.
f. Manufacturer: Advance, OSRAM/Sylvania, Universal Lighting Technologies, Lightolier, or approved.

6. Dimming Electronic:

a. Shall meet all requirements of nondimming electronic ballasts.
b. Ballast shall start lamp at any preset light output and provide continuous, square law dimming from 100 percent to specified low-end output.
c. Control protocol shall be line voltage type with positive line voltage On/Off.
d. 5 Percent Dimming Manufacturer: Lutron Compact SE, Lutron Tu-Wire, Advance MarkX, or approved.
e. 1 Percent Dimming Manufacturer: Lutron Hi-Lume or approved.

D. Provide special types as indicated in the luminaire schedule.

2.3 LAMPS

A. Provide lamps for all luminaires.

B. Provide lamp cataloged for specified luminaire type.

C. Manufacturer: General Electric, Philips, OSRAM/Sylvania (OSI), Venture, or approved unless specific manufacturer is indicated in the luminaire schedule.

D. Provide similar lamps by a common manufacturer unless indicated in the luminaire schedule.

E. Fluorescent:

1. Provide TCLP-compliant lamps when available.

2. Linear Fluorescent:

a. T-8: bi-pin base, tri-phosphor coated, CRI exceeding 82, CCT of 4100 Kelvin, length and wattage as indicated in the luminaire schedule.
b. T-5: bi-pin base, tri-phosphor coated, CRI exceeding 82, CCT of 4100 Kelvin, length and wattage as indicated in the luminaire schedule.
c. Do not provide T-12 lamps.

3. Compact Fluorescent:

a. Single ended, four-pin plug-in base, tri-phosphor coated, CRI exceeding 81, CCT of 3500 Kelvin, wattage and configuration as indicated in the luminaire schedule.
b. Do not provide self ballasted screw-in type unless indicated in the luminaire schedule.

F. Special types as indicated in the luminaire schedule.

2.4 EMERGENCY FLUORESCENT LAMP POWER SUPPLY

A. Manufacturers: Bodine, Iota, Lithonia.

B. Description: Self-contained, battery-operated power supply for operating one T8 or compact fluorescent lamp for a minimum output of 90 minutes.

C. Provide access hatches for emergency battery backup ballasts, adjacent to recessed 6-inch or less diameter downlights installed in inaccessible ceilings.

PART 3 EXECUTION

3.1 COORDINATION

A. Verification of Conditions: Verify ceiling construction, recessing depth and other construction details prior to release of luminaire for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment.

B. Provide all lighting indicated on Drawings with a luminaire of the type designated and appropriate for location. Where outlet symbols appear on Drawings without a type designation, provide a luminaire the same as those used in similar or like locations.

3.2 INSTALLATION

A. Install luminaire of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.

B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.

C. Avoid interference with and provide clearance for equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.

D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.

E. Egress Luminaires: Provide unswitched circuit for battery charging and autotransfer circuiting for exit signs and luminaires with integral batteries.

F. Interior Luminaire Supports:

1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.

2. Maintain luminaire positions after cleaning and relamping.

3. Support luminaires without causing ceiling or partition to deflect.

4. Provide recessed fluorescent luminaires with four supports as required by DSA.

5. Comply with Section 16050, Basic Materials and Methods.

G. Exterior Luminaire Supports:

1. Provide concrete footings for pole-mounted lighting units and bollard lights at locations shown on site plan Drawings. Provide concrete footings as shown on Drawings or as recommended by manufacturer if not shown on Drawings. Minimum base height above grade in automobile areas is 30 inches. Install luminaire poles plumb and straight.

2. Install pole concrete footings in undisturbed or compacted soil. Where soil is disturbed provide backfill and compaction per Division 2 Earthwork requirement.

H. Wiring:

1. Recessed luminaires to be installed using flexible metallic conduit with luminaire conductors to branch circuit conductors in a nearby accessible junction box over ceiling. Junction box fastened to a building structural member within 6 feet of luminaire.

2. Install luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.

3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.

4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.

5. Unit Battery Equipment in Egress Luminaires: Provide unswitched conductor to each egress luminaire from serving circuit. This is for the transfer electronics to determine when power has actually been lost.

I. Relamp luminaires which have failed lamps at completion of work.

J. Test all emergency lighting, supply witnessed documentation of test by authority having jurisdiction.

3.3 ADJUSTING

A. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.

B. Align luminaires that are not straight and parallel/perpendicular to structure.

3.4 CLEANING

A. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.

B. Where finish of luminaires and poles has been damaged, touch up finish as directed by manufacturer's instructions.

END OF SECTION

SECTION 26 50 00

LED LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install a complete lighting system consisting of LED luminaires, drivers, automatic wall switches, occupancy sensors, and appurtenances as shown on drawings and specified.

1.02 WORK INCLUDED

A. The requirements of Sections 26 00 00 and 26 05 00 shall apply to the Work of this Section.

1.03 QUALITY ASSURANCE

A. All materials shall comply with applicable standards of the Underwriter's Laboratories, Inc.

1.04 SUBMITTALS

A. Manufacturer's product data and materials. Include technical specification information, photometric data, dimensional information, fixture efficiency, driver information, lumen output, Wattages, weights, accessories, etc. In addition for occupancy sensors, submit performance specifications, coverage patterns, and load restrictions.

B. Shop Drawings: For the **Wattstopper DLM system**, submit a complete set of shop drawings showing all of the low voltage system components and wiring including sensors, switches, controllers, etc. Include system low voltage wiring. Confirm specific device types/models, such as sensors to be used, such as sensors, and provide recommendation. Note where the recommended device conflicts with the design documents for the engineers review.

C. Submit per Section 26 00 00.

D. As-builts drawings, product information, and O&M Manuals shall be furnished upon completion of the project.

PART 2 - PRODUCTS

2.01 LED LUMINAIRES

A. Fixtures shall comply with the following:
   1. UL Listed.
   2. Minimum 5-year warranty.

3. L70 or L80 performance at 50,000 hrs.
4. Photometrics testing and delivered lumens tested in accordance with IESNA LM-79.
5. Testing for LED life and maintenance shall be per IESNA LM-80.
6. Exterior fixtures to be rated for wet locations, IP65 rated.

2.02 LUMINAIRES

A. Luminaires recessed in ceiling shall conform with UL Standards. Equip fluorescent luminaire with fixture yoke to prevent tees from spreading where applicable and install field fabricated fire protection box (open ends) constructed of 1-5/8" thick UL listed gypsum board.

B. Weatherproof fixtures shall have neoprene gaskets on fixture trim and door assemblies. Fixture shall be UL listed for wet locations.

C. Luminaire voltage indicated on the plans is for reference. Verify actual voltage required based on the branch circuit.

D. Housing shall be prefinished. Color to be selected by Engineer.

E. Verify fixture mounting to ceiling type. Fixture shall be compatible with the ceiling type.

F. Recessed and Surface Troffers:
1. Lens shall be 0.125" minimum thickness, virgin acrylic, clear prismatic K-12.
2. Fixture housing, trim, door frame, hinges, latches, etc. shall be metal, no plastic parts except for gaskets and sockets.
3. Housing and door shall be 20 gauge steel, paint-after-fabrication.
4. Specification grade quality.
5. Fully enclosed spring loaded cam latches, smooth operation.
6. Five stage phosphate bonding process with baked white enamel finish.

2.03 LOUVERS & WIRE GUARDS

A. Louvers and wire guards for luminaires which are removable for relamping but not hinged shall be securely fastened near each end between the fixture housing and louver/guard using No. 16 jack chain.

2.04 LIGHT POLES

A. Poles shall meet the loading based on the wind rating of the Wind Velocity Map as published by AASHTO with a 1.3 gust factor.

B. Reflector optical systems shall be high reflectance prefinished sheet or fabricated construction; no hydroforming, no spinning.

2.07 EMERGENCY FIXTURES/BALLASTS

A. Emergency drivers in fixtures shall lumen output for a minimum of 90 minutes,

solid state, with NiCad, NiMH, or Lithium batteries rated at 15 yrs., charger, automatic operation, UL listed. It shall be located in or adjacent to the fixture and shall be accessible from the bottom of the fixture. Provide with test switch and indicator lights visible from below. Emergi-Lite, Bodine, or equal. Emergency lumen output shall be as follows:

1. Fixture lumen output up to 2500 lumens: minimum 700 lumen output.
2. Fixture lumen output above 2500 lumens: minimum 1400 lumen output.

C. Emergency fixtures shall be UL listed, dual LED heads, 12Vdc, metal housing, NiCad, NiMH, or Lithium batteries rated 15 yrs., wattage rating at 90-minutes, automatic charger, 100% solid state, indicator lights, test switch, capable of remote operation.

D. The emergency driver/ballast in a fixture that is used for egress lighting and energized only during loss of power.

E. Remote exterior heads shall be weatherproof, gasketed metal housing, with wire guard.

2.08 SENSORS, SWITCHES, CONTROLLERS

A. Products to be Watt Stopper or equal.

B. Intelligent lighting system shall be **WattStopper DLM** (Digital Lighting Management). The system shall be complete including but not limited to; occupancy sensors, photo-sensors, dimmer switches, automatic wall switches, plug-load controllers, room controllers, wiring, interfaces, etc. Include network controllers where applicable.

1. Occupancy sensors to include ultrasonic, passive infrared (PIR), and dual-technology ultrasonic & PIR.
2. Automatic wall switches to include 1-8 button switches, dimming switches, 5-button scene switch. Include remote control switches only where specifically indicated.
3. Daylight sensors to include single-zone, multi-zone, closed loop, open loop, and dual loop. Daylight sensors are self calibrating.
4. Controllers to include dimming and non-dimming room controllers and plug-load controllers.
5. Network components to include network bridge, manager, router, and switch.
6. System shall be low voltage 24VDC, plug-n-go, digital, class-2, 24VDC, UL listed, FCC part-5 compliant, 5-yr warranty. Communication and power delivered via Cat-5e cables and RJ45 connectors. Star or daisy chain connections. Up to 1000 ft of cable for DLM local network, 150 ft allowance per communicating device. BACnet compatibility. RoHS compliant.

C. Non-Intelligent system standalone Devices:

1. Automatic Wall Switches, PIR: PW-100 single and PW-200 Double, with manual-ON or auto-ON for each output relay.
2. Ceiling Sensors, Ultrasonic: WT-605 (500 sf), WT-1105 (1000 sf), WT-2205 (2000 sf), WT-2255 (10x90 linear ft)
3. Dual Technology: DT-200, PIR and ultrasonic, wall or ceiling corner mount.
4. Dual Technology: DT-300, PIR and ultrasonic, center ceiling mount.

5. PIR Sensors: CX-105 (wall), CI-205 (ceiling).
6. Power/Switch Packs: As required for proper system operation.
7. Provide with relays where needed proper for system operation.

D. Wall switches: Shall be capable of desktop detection of 300 sf and gross motion of 1000 sf; loads from 0 to 800 watts at 120 Volts, 0 to 1200 Watts at 277 Volts; 180 degrees coverage; zero crossing circuitry; no leakage current to load; selectable for auto-ON or manual-ON for each output relay/circuit.

E. PIR Sensors: Utilize Pulse Count Processing and Digital Signature Analysis; mixed signal ASIC from false triggering to RFI and EMI interference; multiple segmented Lodif fresnel lens in multi-layer configuration with internal grooves.

F. Ultrasonic Sensors: Utilize advanced signal processing to adjust detection threshold dynamically to compensate for constantly changing levels of activity and air flow in the space; crystal controlled at 25 kHz, 32 kHz, or 40 kHz with maximum +/-0.005% tolerance for reliable performance and to eliminate sensor cross talk.

G. Dual Technology: Shall utilize PIR and ultrasonic technologies. Both technologies to switch ON, either technologies to remain ON.

H. All sensors: Shall have readily accessible user adjustable settings for time delay and sensitivity; bypass manual override in event of failure; LED visual indication of detected motion; UL rated.

I. Dimmer switches to be decora paddle style ON/OFF control with sliding dimming control, 0-10V dimming, Lutron Diva series or equal. Provide 0-10V class-2 control wiring or 0-10V class-1 control wiring. Class-1 wiring may be routed with line voltage conductors.

2.09 WIRING

A. Fixtures shall be wired with conductors having insulation suitable for the environmental conditions, current, voltage, and temperature to which the conductors are subjected.

B. 120/208 Volt Luminaire: 300 Volt, type AF, HFF, KFF, SFF, ZFF, or equal, beginning at separately mounted outlet box.

C. 277/480 Volt Luminaire: 600 Volt, type HFF, KFF, PFF, ZF, ZFF, or equal, beginning at separately mounted outlet box.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to reflected ceiling drawings; coordinate therewith for ceiling fixture installations throughout building. Luminaires shall be adequately mounted, wired, tested and left in an operating condition, complete with lamps, wattage as

shown.

B. All dirt, plaster, paint, etc., on luminaires and lenses shall be removed before work will be accepted. Mounting of luminaires shall be in strict accordance the CEC Section 410.

C. Report changes in outlet locations of luminaires found necessary due to interference with structure, pipes, ducts, etc., to Architect for approval before installation. Luminaires specified with overall lengths are subject to change. Check job conditions; adjust as directed.

D. Install recessed luminaires with separate junction box, flexible conduit and heat resisting wire as required by CEC. Set junction box in furred space facing luminaire for maximum accessibility. Furnish and install metal ceiling frame so luminaire can be removed without damaging finish.

E. In wire suspended lay-in grid ceilings, all fixtures shall be positively attached to the ceiling suspension system by mechanical means, with screws or approved fasteners. Positively attached each end of the fixture against the T-bar runner with (2) #8 screws, or other method approved by the AHJ. In addition:
1. Light fixtures weighing 10 lbs or less shall have a minimum of (1) #12 gauge slack safety wire connected to the fixture housing and the structure above.
2. Light fixtures weighing greater than 10 lbs and 56 lbs or less may be supported directly on the ceiling runners, but they shall have a minimum of (2) #12 gage slack safety wires attached to the fixture housing at diagonal corners and attached to the structure above.
3. Light fixtures weighing greater than 56 lbs shall be independently supported by not less than (4) taut #12 gage wires attached to the fixture housing and structure above.
4. All 4 ft. x 4 ft. fixtures shall be supported the same as the fixtures weighing more than 56 lbs.

G. In addition to the cable, rod, stem, conduit, or chain support for a suspended light fixture, seismically secure suspended fixtures to the structure above with #12 ga hanger wire(s) or cable(s) at each suspension point. Wire/Cable shall be secured to the structure above, passing through each hanger, and then securing to the fixture. The wire/cable shall be capable of supporting 4 times the weight of the fixture.
1. Where suspended fixtures and associated assembly cannot swing 45 degrees in all directions without obstruction, seismically brace suspended fixtures with "aircraft" cable to the wall, ceiling, and/or building structure with method approved by the AHJ to prevent movement.

H. Recessed light fixtures installed in a rated ceiling shall have a rated enclosure, around the light fixture equal to the ceiling rating. The enclosure shall be of the same material as the ceiling and shall maintain a 3" clearance from the light fixture.

I. Insulation shall not be installed above a recessed fixture or within 3" from the fixture, unless the fixture is rated for direct contact with the insulation (Type-IC).

J. At each light pole, provide a 5/8" x 8 ft. steel ground rod vertically driven through base of pole before concrete pour, or provide the ground rod in the adjacent pull box. Ground bond rod to pole.

K. Where the pole light is on a raised base of 24" above ground or higher, the nearest point of the based to the face of curb shall be 12", or for a 24" diameter base the center of the pole shall be 24" from the face of curb. Where the pole light is not on a raised base, the nearest point from the pole to the face of curb shall be 5 ft. Pole lights located at the back of walk shall have the center of the pole 12" from the sidewalk.

1. Provide 4" thick concrete pad from the pole light base to the curb (or back of walk) for the full width of the base. The pad shall be flush with curb or walkway.

L. Where individual light fixtures are shown installed end-to-end or side-by-side for, provide through wiring. Where through wiring is not allowed, provide additional circuiting to connect the individual fixtures.

## 3.02 ACCEPTANCE TESTING, CERTIFICATION, AND COMMISSIONING

A. Provide acceptance testing and commissioning in accordance with Title-24 California Energy Commission Building Energy Efficiency Standards. After system installation, provide testing and commissioning by the manufacturer's factory authorized technician to verify proper system adjustments, systems settings, systems testing, sensor placements, and train owner's personnel for adjustment and maintenance. Testing shall include (subject to systems installed):

1. Occupancy Sensors.
2. Manual controls and switching, including multi-level controls.
3. Manual Daylighting Controls.
4. Automatic Daylighting Controls.
5. Automatic Time Switch Controls.
6. Demand Response Controls.

B. Complete and submit the applicable Certificates of Installation and the Certificates of Acceptance. The certificates include (depending on the systems installed):

1. NRCI-LTI-01-E, Indoor Lighting
2. NRCI-LTI-02-E, Energy Management Control System or Lighting Control System
3. NRCI-LTI-03-E, Certified line-voltage track lighting integral current limiter, and supplementary overcurrent protection panel
4. NRCI-LTI-04-E, Two Interlocked Lighting Systems
5. NRCI-LTI-05-E, Power Adjustment Factor (PAF)
6. NRCI-LTI-06-E, Additional wattage installed in a video conferencing studio
7. NRCA-LTI-02-A, Lighting Control Acceptance
8. NRCA-LTI-03-A, Automatic Daylight Control Acceptance
9. NRCI-LTO-01-E, Certificate of Installation; Outdoor Lighting
10. NRCI-LTO-02-E, Certificate of Installation; Energy Management Control System or Lighting Control System

11. NRCA-LTO-02-A, Certificate of Acceptance, Outdoor Lighting Controls

3.03 WARRANTY

A. All materials and installation shall be provided with a one (1) year warranty which shall include replacement parts, labor, retesting, and travel to and from the job site. The warranty period shall begin after final acceptance of the project.

1. Occupancy sensors & automatic wall switches to have a 5 year warranty.

END OF SECTION 26 50 00

# SECTION 27 00 00 – COMMUNICATIONS, PAGING, & SIGNAL CONTROL

1. GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work specified in this Section.

1.2 SCOPE

A. The installation shall include a telephone/speaker communication system. In addition, provide an electronic system for processing, control and distribution o audio and time tone signals to the classrooms, and add new outdoor speakers as indicated in drawings. Include the furnishing of all materials, equipment, supplies and labor and perform all operations necessary for the installation of the complete systems, as indicated on the drawings and/or described herein. System by Rauland-Borg Corporation ICS or Dukane Starcall or equal.

1.3 MANUFACTURER

A. The contractor shall furnish and install all equipment, accessories, and materials necessary for a complete operating system in accordance with the specification and applicable drawings.

B. The equipment furnished under this specification shall be the standard product of one manufacturer and shall be equal in performance and quality to that manufactured by Rauland-Borg Corporation ICS or Dukane Starcall or equal. Products having less than 5 years field service will not be acceptable.

C. The contractor shall guarantee availability of local service (within 50 miles) by factory-trained personnel from an authorized distributor of the equipment manufacturer. The distributor shall have available stock of the manufacturer's standard parts. On-the-premises maintenance shall be provided for a period of twelve (12) months from date of completion on installation.

D. On-the-premises demand service at other than normal working hours shall also be available and may be charged for by the manufacturer's distributor at the prevailing labor rates.

E. Approved manufactures representative shall provide on-site training for site and maintenance personal, as well as furnish District with complete as-built drawings.

1.4 SUBMITTALS AND SUBSTITUTIONS

A. Within thirty-five (35) calendar days after the date of the award of the contract, the Contractor shall submit to the Owner for review eight (8) copies of a complete submission. The submission shall consist of five (5) major sections with each section separated with insertable index tabs. The first section shall be the "Index" which shall include the project title and address, name of the firm submitting the proposal and name of the Engineer and Owner. Each page in the submission shall be numbered chronologically and shall be summarized in the index. The second section shall include a copy of the authorized distributor's valid C-61 California State Contractor's License, letters of factory authorization and guaranteed service, list of projects of equal scope and a list of proposed instrumentation to be used by the Contractor. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment in the specifications. The fourth section shall contain a wiring destination schedule for each circuit

leaving each piece of equipment. The fifth section shall include a complete drawing with devices and wire type and quantity.

B. For purposes of determining equality, all mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered as part of these specifications and binding herein. Any proposed equal item offered shall be substantiated fully to prove equality. The Owner reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent testing laboratory to prove equality. The decision of the Owner regarding equality of proposed equal items will be final.

C. Submit equipment prints, inter-panel and intra-panel, full electronic wiring diagrams and specification sheets for each item specified herein. Provide a tabulation of the specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification Sheets shall be submitted on all items including cable types.

D. Shop drawings, detailing Integrated Electronic Communications Network system including, but not limited to, the following:

1. Built-in station arrangement

2. Equipment cabinet arrangement

3. Wiring diagrams, detailing wiring for power, signal and control, differentiating clearly between manufacturer installed wiring and field installed wiring. Identify terminals to facilitate installation, operation and maintenance.

4. Submit wiring diagrams showing typical connections for all equipment.

5. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections and all provisions available and made for adaptability of all specified future functions. In addition, riser diagram must include all calculations, charts and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades and levels at all required points and locations.

6. Submit a certificate of completion of installation and service training.

1.5 OPERATING AND SERVICE MANUALS

A. The Contractor shall provide two copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following:

1. Instruction necessary for the proper operation and servicing of the system.

2. Complete as-built installation drawings of the system.

3. A wiring destination schedule for each circuit leaving each pierce of equipment.

4. Schematic diagram of each amplifier and other major components with transistor complements and replacement number.

1.6 FUNCTION AND OPERATION

A. The communication system shall consist of classroom loudspeakers, and intercom system and handsets.

1. The classroom loudspeakers will be used to transmit audio paging and electronic generated time tones. Amplifiers, control relay panels shall be interconnected to provide proper signal distribution and access to
2. the paging system from selected handsets.

3. The intercom system and telephone system shall be programmable through the administrative display telephone. Remote programming and scheduling shall be included to be accessed via a computer link located at the District Maintenance and Operations Yard.

B. The communication system shall provide at least the following features and functions.

1. The Administrative Telephones shall be a standard push-button dialing telephone complete with solid-state pre-tuned tone oscillators identical to those employed by the public telephone companies.

2. The Intercom Central Switching Exchange shall be of the modular plug-in printed circuit board type, utilizing NMOS microprocessor and memory, solid-state sensing and logic, and shall also provide two-wire balance transmission complete with dial tone, automatic ringing and busy signal facilities.

3. Direct dialing private two-way telephone communications between all locations equipped with administrative telephone and staff telephone shall also be provided.

4. Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way "amplified voice" communications. The warning tone signal shall sound as soon as the station is selected, and shall be automatically repeated at regular intervals.

5. Automatic Queuing shall be provided for the two-way amplified voice communication channels. A call waiting shall be automatically connected when a channel becomes available.

6. The amplified voice communication channel shall have automatic level control on return speech to assure a constant return speech level.

7. Capability for any administrative telephone to transfer a "call" from another administrative telephone or any staff (classroom) telephone to any other telephone.

8. Facilities for conference calls between administrative telephones and staff (classroom) telephone.

9. Facilities for the instantaneous distribution of emergency announcements simultaneously to all locations equipped with loudspeakers, by dialing a pre-determined code number.

10. Provisions for restricting access to the Emergency Announcements to certain administrative telephones.

11. Facilities to easily change the dial code number of any circuit. The assignment of the architectural numbers shall be accomplished by the use of any authorized

administrative telephone.

12. The system shall be expandable up to 100 telephone and/or speaker circuits.

13. Call origination by Alpha Numeric display and tone shall be provided. An authorized administrative telephone shall be capable of assigning calls originating from any staff location to either or both of two display locations. Coordinate and verify assigned room numbers with SUSD Facilities Planning.

14. Facilities for the origination of both normal and priority calls from any staff station shall be provided. Priority (Emergency) calls shall have precedence over all normal calls.

15. Shall access intercom system for paging from selected administrative phones.

16. All access codes and features shall be software controlled.

17. Capabilities for Graphic Display panels shall be provided.

18. Provisions for instantaneous distributions of announcements to sixteen (16) pre-scheduled groups of speakers from any location equipped with and administrative telephone.

19. The assignment of speaker locations into any of the sixteen (16) zones for zone paging of time signals shall be accomplished by the use of an authorized administrative telephone.

20. Provide an All-Cancel function from an Administrative Telephone to cancel all classroom-annunciated calls.

21. The systems should have completed interconnect capabilities to central office lines. It shall be possible to transfer central office lines to any station in the system. Access to the outside lines can be limited to certain authorized telephones.

22. Diagnostic functions shall be provided to simplify maintenance.

1.7 QUALITY ASSURANCE

A. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least five years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

C. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

D. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:

1. Article 250, Grounding

2. Article 300, Part A. Wiring Method

3. Article 310, Conductors for General Wiring

4. Article 725, Remote Control, Signaling Circuits

5. Article 800, Communication Systems

E. EIA Compliance: Comply with the following Electronics Industries Association Standards:

1. Sound Systems, EIA-160

2. Loudspeakers, Dynamic Magnetic Structures and Impedance, EIA-299-A

3. Racks, panels and Associated Equipment, EIA-310-A

4. Amplifiers for Sound Equipment, SE-101-A

5. Speakers for Sound Equipment, SE-103

F. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers and be prepared to offer a service contract for system maintenance on completion of the guarantee period to provide the names, locations and size of ten (10) recent successful installations in the area.

G. The agency providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. The agency must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. The agency must have established business for and currently be providing all services for the equipment to be provided for a minimum of five (5) years.

H. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. On-the-premise maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect or accident. Additionally, al Rauland-Borg manufactured products are covered by a five (5) year (parts only) limited warranty from the date of acceptance. The warranty period shall begin on the date of acceptance by the owner/engineer.

I. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

J. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver products in factory containers. Store in a clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.9 IN-SERVICE TRAINING

A. The contractor shall provide a minimum of eight hours of in-service training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

2. PRODUCTS

2.1 GENERAL

A. The Contractor through the authorized manufacturer's representative shall furnish and install all equipment, material, devices, labor required and necessary to provide proper operation of the public address and intercommunication system in complete compliance with the function and general conditions described preceding, whether or not all such equipment, material, etc., is specifically called out herein.

B. The Contractor's bid shall include the cost of all labor, materials, including circuit boards, transistors, pilot lamps, fuses, appliances, equipment, and adjustments required to maintain the sound system in first class operation conditions for a period of one (1) year following completion date of the contract. This shall apply to repairs and maintenance made necessary by normal wear and usage.

C. The Contractor shall also guarantee to maintain a full inventory of all necessary replacement parts within the area and to provide service as required herein within 24 hours of proper notification.

2.2 EQUIPMENT AND MATERIALS

A. The intercoms system shall be a Rauland Telecenter ICS or Dukane Starcall Communication System,. The electronic components and circuit boards shall be contained in the wall mounted surface type enclosure. The system shall contain all necessary power supplies, processor, circuit cards relay cards and necessary plug-in modules to accommodate stations as shown on the drawings.

B. Classroom speakers shall be vandal resistant and white in color.

C. Outside speakers shall be vandal resistant and weatherproof. Outside speakers shall provide adequate volume for the environment.

D. Wiring shall be done per manufacturer's recommendation, West Penn #372; all terminal connections to be on barrier strips. All cables to be labeled at all termination points with the room numbers they are providing connection to.

E. Provide two (2) consoles or telephones (one telephone/console for the intercom/paging functions and a separate telephone/console for the general telephone functions) at the attendant position shall be considered in direct conflict with the intent of this specification and therefore shall be deemed not acceptable.

F. Central Controller Unit: The integrated Electronic Communications Network shall have the following capabilities:

1. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.

2. Facilities for centralized attendant answering

3. The system shall provide Personal Identification Numbers for selected administrators. By dialing their PIN at any system telephone, the administrator shall have an access to the same intercom/paging capabilities assigned to their office telephone, regardless of the restrictions on the phone they are currently using.

4. Provide multiple attendant positions for answering internal intercom calls.

5. Facilities for the central control unit to store information and give reports on features, system activity etc., upon request either on site or remotely.

6. Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way communications to alert the station attendant (classroom teacher) to the call and prevent unauthorized monitoring.

7. Facilities for access to any single loudspeaker unit, zone loudspeaker unit or all loudspeaker units. The warning tone signal shall sound as soon as the station is selected and shall be automatically repeated at regular intervals for the duration of the call if the voice circuit is not activated.

8. Direct Dialing, two-way amplified voice intercom between all locations equipped with administrative telephones and staff station speakers without the use of a press-to-talk or talk-listen switch.

9. The Central Controller Unit shall provide a LAN Port for the connection of on-site or off-site diagnostics by distributor or factory-trained personnel.

    a. This port shall be usable for the programming and saving of all programmed data for each system with the utilization of an on-site or off-site computer.

    b. This port shall provide the capability of logging of various activities within the system.

10. Facilities for executive override permitting an assigned telephone to “override” on-going intercom conversation(s) in the system.

11. Facilities for the instantaneous distribution of emergency announcements simultaneously, by a single button access, to all locations equipped with speakers.

    a. Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.

2. Facilities for the distribution of alarm signals to all areas equipped with speakers by single button access.

    a. Up to nine (9) separate distinct alarm signals shall be provided. Each of the distinct alarm signals can be activated by a designated single button.

3. Facilities for the origination of both “normal” and “emergency” calls from any staff location. Calls may originate from either a separate call switch or via speed-dial button on the Staff Phone.

4. It shall be possible to review all calls stored in memory in the order received.

5. Facilities for answering calls registered in the digital read-out display merely by pressing a single response button. This capability shall not prevent other calls for being placed or answered by dialing their numbers.

6. Facilities to cancel all staff station originated calls from any administrative telephone.

7. Facilities for assigning or changing classroom numbers by architectural or any desired numbering system; either three-digit, four-digit, or five-digit numbers may be assigned.

8. Time signal tones shall be generated on a manual or automatic basis.

9. Emergency tones shall be distributed for designated Administrative Telephones.

10. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count.

G. Program Distribution System:

1. The system shall provide facilities to distribute program material (i.e. cassette tape, CD, radio broadcasts) in the following manner:

   a. The media operator shall cue remotely located music source or select radio station.
   b. The media operator shall then “direct select” room(s) or areas to send the program via a switch panel.

   **OR**

   The media operator shall dial from an Administrative Telephone to select the room(s) or areas to distribute program.

2. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count, provide a minimum of ½ watt power to all intercom speaker locations plus 15 watts power to all horn type speaker locations.

H. Time Programming: The master time controller shall provide the following functions:

1. Non-volatile memory capacity for storing 550 events and up to 100 Calendar dates for schedule changes.

2. Ability to review, edit and delete events via a Windows PC running the configuration program.

3. Review events from any entered time of day.

4. Events shall be programmable to any of all of eight (8) zone circuits.

5. Selection of any of eight (8) scheduled to allow flexibility due to seasonal changes or special events.

6. Fully automatic Calendar execution.

7. User-programmable Automatic Daylight Savings Time Change.

8. Programmable Music-on-Class-Change. This feature shall be programmable from 1 to 3600 seconds (60 minutes).

9. Separate bell-tone selection and separate bell duration for each event.

10. Latched operation of zones to control lighting or other devices.

11. Interface with most types of secondary slave clocks whether synchronous wired or electronic.

12. User-programmable custom slave clock correction. Output relays rated at 5 amperes shall be provided on all zone circuits as necessary.

13. Lithium battery will provide not less than five years battery back-up for timekeeping function.

I. Equipment Racks:

1. Equipment racks shall be located in a climate-controlled area-room as shown on drawings. Equipment racks shall be:

a. Self-contained, specifically engineered racks with provisions for all present and future components as described and recommended within this specifications.

b. Racks shall be accessible from front and rear.

c. All program, zone, time circuitry, data, linkage, power, telecommunications components and circuitry to be located in racks configured as approved by the Engineer.

2.3 TELEPHONES

A. The administrative display phones shall have Digital Readouts (2 required). The administrative telephone display panel shows the time of day and day of week, the current time signaling schedule, and the station numbers and call-in priority of staff stations that have called that particular administrative station. An administrative station shall activate zone pages, alarm signals and external functions, as well as select program sources and distribute or cancel a program to any or all speakers or zones.

B. The enhanced phone the Principal's Office shall be capable of the following (1 required). Enhanced staff stations can dial administrative stations, initiate emergency calls, and enable or disable the reception of program material at their location.

C. The classroom phones shall be call in rocker type switches.

2.4 CASSETTE TAPE PLAYER, CD PLAYER & FM/AM TURNER RECEIVER

A. The tape/cd player/receiver shall be a stereo cassette-tape player, CD player and an FM stereo/FM/AM turner and a stereo amplifier. The tape player shall incorporate an automatic tape reverse feature. The unit shall be installed on a wall-mounted shelf. Complete with a folded Dipole FM antenna.

2.5 PAGING AMPLIFIER

A. Provide one (1) telephone-paging amplifier complete with wall mounting brackets. 70 Hz-12 KHz +- 2.03, 200 watts at less than 2% distortion.

2.6 TERMINAL BLOCKS

A. All conductors in all terminal cabinets, equipment rack, etc., shall be terminated on Siemens 66M1-50 punch blocks or approved equal.

2.7 CONDUCTORS

A. Classroom and Staff Room locations West Penn 357 home run.

B. Administrative phone West Penn 357 home run.

C. All underground intercom wire shall be Aquaseal 292.

3. EXECUTION

3.1 DIVISION OF WORK

A. While all work included under this specification is the complete responsibility of the Contractor, the division of actual work listed following shall occur.

B. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed complete by the Electrical Contractor. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative, and the entire responsibility of the system, its operation, function, testing and complete maintenance for one (1) year after final acceptance of the project by the Owner, shall be the responsibility of this organization.

3.2 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.

B. As further qualification for bidding and participating in the work under this specification the manufacturer's representative shall hold a valid C-61 Contractor's State License Board of California. The manufacturer's representative shall have completed at least ten (10) projects of equal scope, giving satisfactory performance and has been in the business of furnishing and installing sound systems of this type for at least five (5) years. The manufacturer's representative shall be capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

C. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed.

D. The Contractor shall furnish a letter from the manufacturer f the equipment, which certifies that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible and that all new portions of the systems are operating satisfactorily. Further, the Contractor shall furnish a written unconditional

guarantee, guaranteeing all parts and all labor for a period of one (1) year after final acceptance of the project by the Owner.

3.3 INSTALLATION

A. Plug Disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.

B. Protection of Cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or T & B "Ty-Rap" cable. Edge protection material ("cat-tract") shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge. All wiring shall be in conduit. Conceal conduits in ceiling and walls whenever possible. Interior exposed conduits shall be "surface raceway" type installed parallel and at right angle to room dimensions. Surface raceway shall be installed tight against wall/ceiling and wall/wall room edges. Conduit/raceways shall be installed as per section 16110 and CEC.

C. Cable Identification: Cable conductors shall be color-coded and individual cables shall be individually identified. Each cable identification shall be a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.

D. Shielding: Cable shielding shall be connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.

E. All cable and wires shall be labeled at terminal cabinets, speakers, call-in switches and at telecenter station.

F. Nameplates: Terminal cabinets and junction boxes shall have plastic engraved nameplate to identify each with Drawings and Specifications. Nameplate letters or numbers shall be minimum 3/8" high.

G. Provide complete "in service" instructions of system operations o school personnel. Provide programming of telephone system in accordance with school staff.

H. Outlet Box Identification: All outlet boxes mounted in attic space shall be individually identified with waterproof market.

I. All cables shall be run in continuous lengths between terminal cabinets and equipment, no splicing permitted.

J. Provide 6 feet of wires inside speaker box.

K. Contractor is responsible for performing underground survey of all areas to be trenched to locate all existing utilities. Contractor will repair any damaged underground utilities at no cost to the District.

L. All intercom Stations shall be labeled with the circuit feeding the system.

3.4 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk and other impairments. Provide 5-ohm ground at main equipment location. Measure, record and report ground resistance.

C. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.

D. The contractor shall note in his system drawings, the type and location of these protection devices, as well as all wiring information.

E. The contractor shall furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground buss bar.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at the Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

D. Commissioning: Train Owner's maintenance personnel in the procedures and schedules involved in operating, programming schedule, troubleshooting, servicing and preventative maintenance of the system. Provide a minimum of four (4) hours training. Operators Manuals and Users Guides shall be provided at the time of this training.

E. Schedule training with Owner through the Architect with at least seven (7) days advance notice.

3.6 OCCUPANCY ADJUSTMENTS

A. When requested by the Architect within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

**END OF SECTION 27 00 00**

# SECTION 27 13 00 -COMMUNICATIONS BACKBONE CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Work included: Materials, installation and testing of:

1. Fiber Optic Backbone Cable
2. Copper Termination Hardware
3. Fiber Optic Termination Hardware
4. Copper Patch (Jumper) Cords
5. Fiber Optic Patch (Jumper) Cords
6. Splice Cases

1.2 RELATED SECTIONS

A. Contents of Division 27 and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, meet the following:

1. NFPA 780, Standards for Installation of Lightning Protection Systems.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, provide:

1. Shop Drawings that include, but are not limited to, the following: Telecommunication Room layout, Telecommunication Room wall elevations, equipment rack elevations, cable routing, cable connecting diagrams, termination pin outs, supporting hardware details, block diagrams, riser diagrams and cable pathways. Work may not begin until shop drawings are approved. Note: Intent of submitting shop drawings is for contractors to display a conceptual understanding of the issued Engineer drawings. Do not submit Engineer Drawings on your title block.

2. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606-A.

3. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, provide:

1. Labor, materials, and documentation according to Panduit/General manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 25 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T, and 155 Mb/s ATM.

2. Provide a warranty on the physical installation.

3. Furnish necessary documentation required by Panduit/General immediately following 100 percent testing of cables.

4. Administer the warranty process with the responsible Panduit/General representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

A. Provide a standards-based cable system to serve backbone communication systems requirements as specified in these specifications and shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards which apply to backbone communication systems.

B. Install intrabuilding backbone cables from ER-s to TR's through raceway systems as shown on Drawings.

C. Install interbuilding (OSP) backbone cables from EF to ER's through duct and tunnel raceway systems as shown on Drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords, and wall plates. The following manufacturers/solutions are preapproved.

1. ADC

2. Belden

3. BTR Netcom

4. Commscope

5. Corning -fiber optic only

6. Leviton

7. Ortronics/Berk-Tek

8. General or Panduit

9. Mohawk or Siemon

2.2 FIBER OPTIC BACKBONE CABLE

A. Intrabuilding Multimode Riser: 12 strand or 50/125, micron, laser optimized distribution cable with maximum attenuation of 3.5dB/km at 850 nm and 1.5dB/km at 1300 nm. Minimum bandwidth is 500MHZ-km at 850 nm and 500MHZ-km at 1300 nm. OFNR rated.

B. Intrabuilding Multimode Plenum: 12 strand or 50/125, micron, laser optimized distribution cable with maximum attenuation of 3.5dB/km at 850 nm and 1.5dB/km at 1300 nm. Minimum bandwidth is 500MHZ-km at 850 nm and 500MHZ-km at 1300 nm. OFNP rated.

C. Intrabuilding Singlemode Riser: 12 strand, 8.3 micron, high performance low water peak distribution cable with maximum attenuation of .35dB/km at 1310 nm and .25dB/km at 1550 nm. OFNR rated.

D. Intrabuilding Singlemode Plenum: 12 strand, 8.3 micron, high performance low water peak distribution cable with maximum attenuation of .35dB/km at 1310 nm and .25dB/km at 1550 nm. OFNP rated.

E. Interbuilding:multimode 12 strand50/125, micron, laser optimized loose tube cable with maximum attenuation of 3.5dB/km at 850 nm and 1.5dB/km at 1300 nm. Minimum bandwidth is 500MHZ-km at 850 nm and 500MHZ-km at 1300 nm and Singlemode: 12 strand, 8.3 micron, high performance low water peak loose tube cable with maximum attenuation of .35dB/km at 1310 nm and .25dB/km at 1550 nm. Cable will be hybrid under one jacket. Corning or approved equal.

F. General: between MDF and IDF: 12 strand 50/125 micron, laser optimized cable with maximum attenuation of 3.5db/Km at 850 nm and 1.5dB/Km at 1300 nm. Minimum bandwidth is 500MHz-km at 850 nm and 500MHz at 1300 nm AND 12 strand singlemode 8.3 micron, high performance cable with maximum attenuation of .35dB/Km at 1310 nm and .25dB/Km at 1550 nm. Cable will be hybrid under one jacket. Corning or approved equal.

2.3 FIBER OPTIC TERMINATION HARDWARE

A. High Density Fiber Termination Shelf:

1. 1. 7-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 12 adapter panels. The shelf will contain built-in slack management and be accessible from the front or rear with locking doors.

   a. 19-inch Rack Mount, 13-inches deep
   b. 19-inch rack mount, 19-inches deep

2. 3.5-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 6 adapter panels. The shelf will contain built-in slack management and be accessible from the front or rear with locking doors.

   a. 19-inch Rack Mount, 13-inches deep
   b. 19-inch rack mount, 19-inches deep

3. Fiber Adapter Panels:

   a. Adapter panel for high density termination shelf with 6 LC multimode phosphor-bronze alignment sleeves.

4. Preloaded Fiber Termination Shelf:

   a. 1.75-inch high shelf designed for mounting in 19-inch equipment racks with 12 LC multimode phosphor-bronze alignment sleeves. The shelf will contain built-in slack management and be accessible from the front or rear.
   b. 1.75-inch high shelf designed for mounting in 19-inch equipment racks with 24 LC multimode phosphor-bronze alignment sleeves. The shelf will contain built-in slack management and be accessible from the front or rear.

B. Multimode LC Connector:

1. Ceramic tip LC style capable of being terminated on 50/125 fiber with 900 micron buffer.

2. Ceramic tip SC style capable of being terminated on 50/125 fiber with 900 micron buffer.

C. Singlemode LC Connector:

1. Ceramic tip LC style capable of being terminated on 8.3/125 fiber with 900 micron buffer.

2.4 FIBER OPTIC PATCH (JUMPER) CORDS

A. Multimode Fiber Optic Jumpers:

1. Factory terminated double ended, two strand multimode cordage with LC connectors on each end, length as defined by the Owner.

B. Singlemode Fiber Optic Jumpers:

1. Factory terminated double ended, two strand singlemode cordage with LC connectors on each end, length as defined by the Owner.

2.5 SPLICE CASES

A. Fiber Optic: Provide as close as practicable (within 50-feet) of where OSP cable enters building in a duct or conduit system. Size splice cases(s) to accommodate strand count of the cable(s) entering building. Splice case must be capable of bonding to the Telecommunications Main Grounding Bus Bar (TMGB). Complete with end caps to properly seal cable from expanding water blocking gel. Approved manufacturers: Preformed, Corning, and 3M.

2.6 MISCELLANEOUS HARDWARE

A. Provide supporting hardware, cable ties, labels, underground vault racking, bullet bonds, gel blocking kits, pull rope, and other miscellaneous hardware for a complete and operable system.

PART 3 EXECUTION

3.1 GENERAL

A. Communications Backbone Cabling includes cables, jacks, patch panels, connecting blocks, and patch cords, as well as the necessary support systems, such as cable managers, tie wraps, and D-rings.

B. Furnish and install materials necessary for a complete and working system.

C. Contractor must be a Certified Installer for selected manufacturer prior to, during, and through completion of the system installation, and must be able to provide the manufacturer's extended warranty.

D. Perform work in a neat and workmanlike manner.

E. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.

F. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned:

1. Inspect conduit, wireway, cable trays, and innerduct systems prior to installation.

2. Swab any additional enclosed raceway and innerduct systems.

G. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.

H. Install cable ties and other cable management clamps via hand so that it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.

I. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.

J. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.

K. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.

L. If a J-hook or trapeze system is used to support cable bundles, support cables at a maximum of 48 to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.

M. Cable sizes are shown on Drawings. Verify that as a minimum, two cable pairs are provided for each telephone user outlet. Install specified fiber optic cable between TRs as shown on drawings.

N. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

O. Do not attach cables to ceiling grid or lighting fixture wires. Where support for cable is required, install appropriate carriers to support the cabling.

P. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.

1. Install cable in accordance with manufacturer's recommendations and best industry practices.

2. Install cables in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

3. Install transition points or consolidation points in accessible locations and housed in an enclosure intended and suitable for the purpose, where allowed by standards and approved by the Owner's representative.

4. Do not exceed the cable's minimum bend radius and maximum pulling tension.

5. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

6. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.

Q. Splice Case Installation: Provide splice cases within 50-feet of where OSP cable enters building in a duct or conduit system. Size splice cases to accommodate pair or strand count of cable entering building. Properly bond cable entering and exiting splice case to Main Telecommunication Grounding Bus Bar (TMGB). Install end caps to properly seal cable from expanding water blocking gel.

R. Determine requirements for plenum rated cable and devices. When doubt exists, seek prior determination in writing by AHJ.

S. Seal conduits entering from outside the building and install listed firestop material in conduits and sleeves to satisfy CEC and local codes.

T. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document, manufacturer's recommendations and best industry practices.

U. Terminate 4 pair cables on the jack and patch panels using T568A wiring scheme.

V. Maintain the cable jacket within 1-inch of the termination point.

W. Do not exceed 0.5-inch of pair untwist at the termination point.

X. Do not exceed 4 times the outside diameter of the cable in the termination area for bend radiance compliance.

Y. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

3.2 OPTICAL FIBER CABLE INSTALLATION PRACTICES

A. Place fiber optic cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or ten times the cable diameter, whichever is larger.

B. Place fiber optic cable runs in innerduct. Use care when handling fiber optic cable. Carefully monitor pulling tension so as not to exceed the limits specified by the manufacturer.

C. Terminate fiber optic cable in rack-mounted fiber optic terminated units at each end using standard SC style bulkhead connectors.

D. Splicing of fiber optic cable is prohibited unless directed in drawings or approved via RFI.

3.3 TESTING PROCEDURES

A. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C.

B. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks in order to ensure 100 percent useable conductors in cables installed.

C. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.

1. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-569-C standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multi-pair cables, record the shortest pair length as the length for the cable.

2. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.

3. Perform testing with a Level IV tester.

4. The basic tests required are:

a. Wire Map
b. Length
c. Attenuation
d. NEXT (Near end crosstalk).
e. Return Loss
f. ELFEXT Loss
g. Propagation Delay
h. Delay skew
i. PSNEXT (Power sum near-end crosstalk loss).
j. PSELFEXT (Power sum equal level far-end crosstalk loss).
k. Provide test results in written format, with the following minimum information per cable:
l. Circuit ID
m. Test result, “Pass” or “Fail”
n. Date and Time of test
o. Project Name
p. NVP

D. Provide an electronic copy of the test results, in the native tester software format, to the Consultant along with the written test results.

E. Provide a fully functional version of the tester software for use by the Consultant in reviewing the test results.

F. Any failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs), must be reported in writing to the Consultant immediately, along with a copy of the test results.

G. Labeling:

1. Label cables using a machine printed label at each end of the cable at approximately 12 - inches of the termination point, and again at approximately 48-inches from the termination point. Do not use handwritten labels.

2. Label patch panel ports with the cable identifier.

3. Provide the final cable ID matrix to the Architect one week prior to cable installation.

4. Note labeling information on the as-built drawings.

3.4 PATCH CORDS

A. Fiber Optic: Provide sufficient duplex fiber optic jumpers (patch cords) at each fiber termination point to cross-connect one-half the number and type of fibers terminated there, Assume a minimum of 2 duplex fiber optic jumpers per termination point for a 6-strand optical fiber.

B. Provide lengths for a neat appearance not to exceed 15-feet. Some jumpers may require LC to SC, or SC to ST connections to support existing or readily available hardware. Coordinate connector requirements with Owner.

C. Field terminated patch cords and jumpers are not allowed.

## END OF SECTION 27 13 00

# SECTION 27 15 00 -COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Work included: Provision of materials, installation and testing of:

1. Station Cabling
2. Modular Jacks/Adapters
3. Work Area Outlets
4. Termination Block
5. Patch Panels

1.2 RELATED SECTIONS

A. Contents of Division 27 and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Use this Section in conjunction with other Division 27 specifications and related Contract
2. Documents to establish the total general requirements for the project communications systems and equipment.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, meet the following: NFPA 780, Standard for the Installation of Lightning Protection Systems.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, provide:

1. Shop Drawings that include, but are not limited to, the following: Telecommunication Room layout, Telecommunication Room wall elevations, equipment rack elevations, cable routing, cable connecting diagrams, termination pin outs, supporting hardware details, block diagrams, riser diagrams, cable pathways. Work may not begin until shop drawings are approved. Note: Intent of submitting shop drawings is for contractors to display a conceptual understanding of the issued Engineer drawings. Do not submit engineers drawing on your title block.
2. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.
3. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00 and Division 01, General Requirements.

B. In addition, provide:

1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 20 years in length. The Application Assurance. Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-Tand 155 Mb/s ATM.

2. A warranty on the physical installation.

3. Necessary documentation required by the manufacturer immediately following 100 percent testing of cables.

C. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.

B. The horizontal distribution subsystem refers to intra-building twisted-pair and fiber optic communications cabling connecting telecommunications rooms (TRs) to telecommunications outlets (TOs) located at individual work areas and consists of the following:

1. Category 6a 100 Ohm, 4-pair, unshielded twisted pair cables from the TRs to the TOs.

2. The horizontal system includes cables, jacks, patch panels, connecting blocks, patch cords, fiber connectors and jumpers as well as the necessary support systems, such as cable managers and faceplates.

3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, nonventilated spaces above ceiling tile, and through plenum air-handling spaces above ceiling tile.

4. Furnish and install materials necessary for a complete and working system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords, and wall plates. The following manufacturers/solutions are preapproved.

1. ADC
2. Belden
3. BTR Netcom
4. Commscope
5. Corning -fiber optic only
6. Leviton
7. Ortronics/Berk-Tek
8. General or Panduit
9. Mohawk or Siemon
10. Tyco AMP NETCONNECT

2.2 STATION CABLING

A. 50 Micron Optical Fiber Cable:

1. Laser-optimized 50/125-µm fiber optic building cable with nonmetallic construction, a core of individually tight buffered fibers, and listed OFNR. Minimum bandwidth of 1500 MHz-km at 850nm for overfilled launch, 500 MHz-km at 1300nm and 2000 MHz-km characterized using FOTP 220.

   a. Two Strand
   b. Four Strand
   c. Six Strand

2. Laser-optimized 50/125-µm fiber optic building cable with nonmetallic construction, a core of individually tight buffered fibers, and listed OFNR. Minimum bandwidth of 500 MHz-km at 850nm and 500 MHz-km at 1300 nm.

   a. Two Strand
   b. Four Strand
   c. Six Strand

3. Laser-optimized 50/125-µm fiber optic building cable with nonmetallic construction, a core of individually tight buffered fibers, and listed OFNP. Minimum bandwidth of 1500 MHz-km at 850nm for overfilled launch, 500 MHz-km at 1300nm and 2000 MHz-km characterized using FOTP 220.

   a. Two Strand
   b. Four Strand
   c. Six Strand

4. Laser-optimized 50/125-µm fiber optic building cable with nonmetallic construction, a core of individually tight buffered fibers, and listed OFNP. Minimum bandwidth of 500 MHz-km at 850nm and 500 MHz-km at 1300 nm.

    a. Two Strand
    b. Four Strand
    c. Six Strand

2.3 MODULAR JACKS/ADAPTERS

A. Category 6a Modular Jacks:

1. Eight-position modular jack, Category 6a, IDC terminals, T568B wiring scheme

2. Each jack must be stamped or have icons to identify it as CAT 6.

3. Coordinate color with building finishes.

B. Multimode Fiber Modular Adapter:

1. One-strand fiber optic TracJack modular adapter, Simplex SC type connectors, phosphor-bronze alignment sleeves with 180-degree exit

2. One-strand fiber optic TracJack modular adapter, Simplex SC type connectors, phosphor-bronze alignment sleeves with 45-degree exit

3. Two-strand fiber optic TracJack modular adapter, two Simplex SC type connectors,

4. phosphor-bronze alignment sleeves with 180-degree exit

2.4 WORK AREA OUTLETS

A. Flush Mounted Faceplate:

1. Two-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single gang wall box.

2. Four-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single gang wall box.

3. Six-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single gang wall box.

4. Six-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a double gang wall box.

5. Eight-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a double gang wall box.

6. Twelve-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a double gang wall box.

7. Coordinate faceplate color with building finishes. Submit to Architect for approval prior to

8. installation.

B. Flush Mounted Stainless Steel Faceplates:

1. Two-port stainless steel faceplate, with recessed label fields, mounts within a single gang wall box.

2. Four-port stainless steel faceplate, with recessed label fields, mounts within a single gang wall box.

3. Six-port stainless steel faceplate, with recessed label fields, mounts within a single gangwall box.

4. Eight-port stainless steel faceplate, with recessed label fields, mounts within a double gang wall box.

5. Twelve-port stainless steel faceplate, with recessed label fields, mounts within a double gang wall box.

C. Surface Mounted Outlet Boxes:

1. Two-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields.

2. Four-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields.

3. Four-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields, jacks exit from both sides.

4. Six-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields.

5. Coordinate surface box colors with building finishes. Submit to Architect for approval prior to installation.

D. Modular Furniture Faceplates:

1. 0.125-inch deep modular furniture bezel fits 1.375-inch x 2.71-inch furniture knockout.

2. 0.625-inch deep modular furniture bezel fits 1.375-inch x 2.71-inch furniture knockout, with recessed label field.

3. 1-inch deep modular furniture bezel fits 1.375-inch x 2.71-inch furniture knockout, with recessed label field.

4. Three-port modular furniture adapter plate

5. Adjustable Four-port modular furniture faceplate fits 2.67-inch to 2.75-inch x 1.34-inch to 1.41-inch furniture knockout.

6. Four-port modular furniture faceplate fits Herman Miller Beltline furniture openings 2.35-inch x 3.41-inch.

7. Six-port modular furniture faceplate fits Herman Miller Beltline furniture openings 2.35-inch x 3.41-inch.

8. Six-port modular furniture faceplate fits Herman Miller Baseline furniture openings 1.89-inch x 2.99-inch.

9. Coordinate furniture plate colors with building finishes. Submit to Architect for approval prior to installation.

E. Modular Mounting Frames/Covers:

1. Two-port 106-Type duplex frame, mounts within a single gang wall box.
2. Three-port 106-Type duplex frame, mounts within a single gang wall box.
3. Four-port 106-Type duplex frame, mounts within a single gang wall box.
4. Three-port Stylistics rectangular (GFCI) footprint frame, mounts within a single gang wall box.
5. Four-port Stylistics rectangular (GFCI) footprint frame, mounts within a single gang wall box.
6. Single gang 106-Type Plastic Cover Plate
7. Double gang 106-Type Plastic Cover Plate
8. Single gang Stylistics Plastic Cover Plate
9. Double gang Stylistics Plastic Cover Plate
10. Coordinate mounting frame colors with building finishes. Submit to Architect for approval prior to installation.

F. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

2.5 TERMINATION BLOCKS

A. Category 6a 110-style Blocks:

1. Category 6a, 288 Pair, 110-style, with mounting legs, wall -mount.
2. Category 6a, 96 Pair, 110-style, with mounting legs, wall -mount.
3. Category 6a, 288 Pair, 110-style, without mounting legs, rack-mount.
4. Category 6a, 96 Pair, 110-style, without mounting legs, rack-mount.

B. Connecting Blocks:

1. 3 Pair 110-style connecting blocks.
2. 4 Pair 110-style connecting blocks.
3. 5 Pair 110-style connecting blocks.

C. Wiring Troughs:

1. Horizontal trough for routing of patch cords and cross-connect wire, with mounting legs.
2. Horizontal trough for routing of patch cords and cross-connect wire, without mounting legs.

D. 110 Block Labels:

1. Clear plastic holder for 110 blocks with paper inserts, for blocks with legs

2. Clear plastic holder for 110 blocks with paper inserts, for blocks without legs

E. Mounting Brackets: 19-inch rack mount brackets for 200 pair 110 termination blocks and wiring troughs.

2.6 PATCH PANELS

A. Category 6a Modular Patch Panels:

1. 24 port, eight-position modular jack panel, high density, 6 port modules, Category 6a, IDC terminals, T568A/B wiring scheme.

2. 48 port, eight-position modular jack panel, high density, 6 port modules, Category 6a, IDC terminals, T568A/B wiring scheme.

3. 24 port, eight-position modular jack panel, high density, 8 port modules, Category 6a, IDC terminals, T568A/B wiring scheme.

4. 48 port, eight-position modular jack panel, high density, 8 port modules, Category 6a, IDC terminals, T568A/B wiring scheme.

B. Universal Patch Panels:

1. 19-inch rack mounted panel with isolation capable of accepting up to 24 modular jacks.

2. 19-inch rack mounted panel capable of accepting up to 24 modular jacks.

2.7 MISCELLANEOUS HARDWARE

A. Provide supporting hardware, cable ties, labels, underground vault racking, bullet bonds, gel blocking kits, pull rope, and other miscellaneous hardware for a complete and operable system.

PART 3 EXECUTION

3.1 GENERAL

A. Horizontal cabling includes cables, jacks, patch panels, connecting blocks, and patch cords, as well as the necessary support systems, such as cable managers and faceplates.

B. Furnish and install materials necessary for a complete and working system.

C. Contractor must be a Certified Installer for selected manufacturer prior to, during, and through completion of the system installation, and must be able to provide the manufacturer's extended warranty.

D. Perform work in a neat and workmanlike manner.

E. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.

F. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.

1. Inspect conduit, wireway, cable trays, and innerduct systems prior to installation.

2. Swab any additional enclosed raceway and innerduct systems.

G. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.

H. Install cable ties and other cable management clamps via hand so that it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.

I. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.

J. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.

K. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.

L. If a J-hook or trapeze system is used to support cable bundles, support horizontal cables at a maximum of 48-to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.

M. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

N. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

O. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.

P. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.

Q. Determine requirements for plenum rated cable and devices. When doubt exists, seek prior determination in writing by AHJ.

R. Unshielded Twisted Pair Cable Installation Practices:

1. Install cable in accordance with manufacturer's recommendations and best industry practices.

2. Install cables in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

3. Install transition points or consolidation points in accessible locations and housed in an

4. enclosure intended and suitable for the purpose, where allowed by standards and

5. approved by the Owner's representative.

6. Do not exceed the cable's minimum bend radius and maximum pulling tension.

7. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

8. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.

S. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:

1. Open or Nonmetal Communications Pathways:

a. 12-inches from electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA.
b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
c. 48-inches from large electrical motors or transformers.

2. Grounded Metal Conduit Communications Pathways:

a. 2 1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

3.2 UNSHIELDED TWISTED PAIR TERMINATION

A. Coil cables in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. Do not store more than 12-inches of UTP and 36-inches of fiber slack in an in-wall box, modular furniture raceway, or insulated walls. Loosely coil and store excess slack in accessible ceiling space above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.

C. Terminate 4 pair cables on the jack and patch panels using T568A wiring scheme.

D. Maintain the cable jacket within 1-inch of the termination point.

E. Do not exceed 0.5-inch of pair untwist at the termination point.

F. Do not exceed 4 times the outside diameter of the cable in the termination area for bend radiance compliance.

G. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

3.3 TESTING PROCEDURES

A. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C.

B. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks in order to ensure 100 percent useable conductors in cables installed.

C. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.

D. Test Unshielded Twisted Pair Cables as Follows:

1. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level III test unit for Category 6a performance compliance as specified in ANSI/TIA/EIA-568 C.1, C.2.

2. Continuity -Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests.

3. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and retest the cable prior to final acceptance.

4. Length -Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.

E. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.1, C.2.

F. Perform testing with a Level IV tester. The basic tests required are:

1. Wire Map

2. Length

3. Attenuation

4. NEXT (Near-end Crosstalk)

5. Return Loss

6. ELFEXT Loss

7. Propagation Delay
8. Delay Skew
9. PSNEXT (Power Sum Near-end Crosstalk Loss)
10. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)

G. Provide test results in electronic format, with the following minimum information per cable:

1. Circuit ID
2. Test Result, “Pass” or “Fail”
3. Date and Time of Test
4. Project Name
5. NVP
6. Cable Length
7. Tester Name

H. Provide an electronic copy of the test results, in the native tester software format, to the Consultant along with the written test results.

I. Provide a fully functional version of the tester software for use by the Consultant in reviewing the test results.

J. Any failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs), must be reported in writing to the Consultant immediately, along with a copy of the test results.

K. Labeling.

1. Label horizontal cables using a machine printed label at each end of the cable at approximately 1 inch from the termination point on each end, approximately 12-inches of the termination point, and again at approximately 48-inches from the termination point. Do not use handwritten labels.
2. Label patch panel ports and TO ports with the cable identifier.
3. Denote the TO ID, as well as the unique cable number for that TO, i.e. A-001-A for cable
4. number 1, A-001-B for cable number 2, and so forth on the labels. Provide the final cable ID matrix to the Architect one week prior to cable installation.
5. Note labeling information on the as-built drawings.

3.4 PATCH CORDS

A. Field terminated patch cords and jumpers are not allowed. At a minimum, provide equipment connection cords for one-half the total number of cables installed at each termination point. For example: A telecommunications outlet with four Category 6a cables installed would require two Category 6a equipment connection cords at the work area outlet and two

Category 6a equipment connection cords in the telecommunications equipment room for a total of four Category 6a equipment connection cords. A telecommunications outlet with a 4-strand fiber optic cable installed would require one duplex fiber optic patch cord(s) at the work area outlet and one duplex fiber optic patch cord(s) in the telecommunications equipment room for a total of two duplex fiber optic patch cord(s). Provide equal amounts of each length indicated in Part 2, Products.

3.5 COORDINATION OF CONDITIONS

A. Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.

END OF SECTION

## SECTION 27 41 00 – CABLE TELEVISION BASIC MATERIALS AND METHODS

1. GENERAL

1.1 No entrance from the roof to the classroom.

1.2 All penetration holes must be sealed.

1.3 All penetrations will be made with the smallest opening diameter possible.

1.4 All holes/and or penetrations will be from the sidewall of the classroom.

1.5 All cables will be neatly arranged and inconspicuous as possible.

1.6 All cables installed on the exterior of the buildings shall be installed in approved raceways.

1.7 All cable connectors will be protected from environmental conditions.

1.8 Prior to installation, a district representative must approve aerial installations.

1.9 Underground installations must be in approved raceways.

1.10 Wire entering the room must be terminated in a cable enclosure.

1.11 All wire in the classroom will be in an approved raceway.

1.12 All cable installations must include a cable from the cable termination in the classroom to the television and/or V.C.R.

1.13 All work shall be performed in a professional-like manner, including clean up after the installation is complete.

1.14 An as-built drawing shall be submitted to the district planning and operations office at the completion of installation.

1.15 All raceways and cables are to be installed per Specification Section 16010 and 16110.

**END OF SECTION 27 41 00**

# SECTION 28 16 00 – HARDWIRED INTRUSION ALARM

## PART 1 GENERAL

### 1.1 WORK INCLUDED

A. General Conditions and requirements of Division 1, Section 26 00 00 and Section 26 05 00 apply to work hereunder.

B. Furnish and install addition to existing Intrusion Detection and Alarm system including all wiring and connections and other materials as shown on Plans and specified herein. It is the intent that a compete operating system conforming to all applicable codes be installed and that any power supplies, relays, resistors, programming, or other items required to achieve this end result shall be furnished whether or not such item or items are specified herein.

C. The contract Drawings and Specifications indicate the general scope of the Intrusion Alarm System. The bidder shall insure that the system conforms to all applicable codes and District intrusion alarm requirements. The bidder shall verify all District alarm requirements with representative, and include them in the bid whether specifically mentioned herein or not. The Contractor responsible for this section of the Specifications shall lay out all devices, equipment, conduit, wiring, etc. And submit drawings per paragraph “Submittals” hereinafter. All locations and spacings shall conform to applicable codes. Any additional detection and signaling devices required by codes and the District shall be provided as part of this contract.

D. It is the contractor’s responsibility to provide the School District with a complete and working system that meets the intent of these specifications. Omissions in the written specifications and/or plans will not relieve the contractor of this responsibility.

### 1.2 GENERAL REQUIREMENTS

A. SYSTEM REQUIREMENTS:

1. All of various equipment components to be complete with all appurtenant accessories required to provide specified facilities and perform specified functions throughout presently planned construction and space; and provisions for expanding system to provide same facilities, and perform same functions in all future planned construction, including space and mountings in control panels and terminal cabinets.

B. INSTRUCTIONS AND MANUALS:

1. Equipment supplier of systems to demonstrate complete operation of system to satisfaction of Owner’s maintenance personnel and School Administrative staff. Provide training to staff for programming and use of all equipment.

2. Manuals with wiring schematics, installation instructions, and details of all routine maintenance and servicing which must be given system by Owner shall be provided in substantial fiberboard covers, with title page, list of contents, and conspicuous label on cover and shall be delivered to District. Submit to architect for approval before delivering to Owner. Refer to Section 26 00 00 and 26 05 00 for detailed requirements.

C. Installation of the intrusion alarm system and equipment shall not be started until submittals, for each component of the system, have been submitted to and approved by Architect and

the District Facilities Planning. Contractor is responsible for submission and approval and shall submit all materials via Architect.

D. When the alarm contractor proceeds without coordination and approval of the District Facilities Planning, then all drawings and specifications may be superseded by later detailed specifications and detailed alarm drawings prepared by Stockton Unified School District Facilities Planning, and the alarm contractor shall conform to them and to such changes as may be called for by those revisions without extra cost to the District. Where work called for exceeds code requirements, the drawings and specifications shall take precedence.

1.3 SUBMITTALS:

Furnish the following as a minimum:

A. Scope of project.

B. Scaled site plan and building floor plans showing intrusion alarm device locations.

C. Single line riser diagram and point-to-point diagram.

D. Use of “E” drawings for intrusion alarm limited to intrusion alarm equipment only. All other signal, fixture, and power references shall not be permitted.

E. Manufacturer’s specification sheet on all intrusion alarm equipment.

F. DSA project number and school district/school file number.

G. Complete symbol legend for all intrusion alarm devices being installed.

H. Elevation detail of detection devices.

I. Identification of type of wiring used.

J. Details on support and anchorage of intrusion alarm equipment weighing over 20 pounds.

K. Sequence of operations/events when alarm system is activated:

1. Building plans shall be 1/8” = 0”, and site plans shall be no smaller than 1” = 40’. Contractor shall also submit name of firm he proposes to do work under this Section, addresses, phone numbers, and name of firm’s contact, for approval. Such firms shall be factory authorized representatives of the equipment specified, who shall furnish all equipment, make all connections to same, and place the systems in operation. Such firms shall have offices and service departments within a 75-mile radius of project and shall have been in business of this type for at least five years.

2. The intrusion alarm system contractor must have completed similar systems in the past five years and shall include in submittal, a list of contracts of the work performed at schools within the past five years. Additionally, the intrusion alarm system contractor shall be licensed by the California Consumer Affairs Department, Bureau of Collections and Investigations and possess a valid Alarm Company operators license. Only contractors holding valid licenses shall perform any alarm work on project. A copy of the licenses shall be provided with submittal. Also, refer to requirement for shop drawings, substitutions, materials, and submittals in Section 16010, Electrical. Stockton Unified School District Facilities Planning shall provide three additional copies of the submittal for review. The Architect’s representative will make two submittal reviews. Subsequent

reviews will be charged to the Contractor. A rejection of a submittal or review of a partially presented submittal constitutes one submittal review.

L. RECORD DRAWINGS: Refer to General Conditions and Section 16010. Final punch list will not be provided until drawings are received and approved.

M. Manufacturer's DIRECTIONS: The alarm contractor shall follow manufacturer's directions where these directions cover points not included in the drawings or in these specifications, after obtaining written approval from the District Facilities Planning.

1.4 GUARANTEE:

A. One firm to assume full responsibility for performance on all work of this section. Guarantee all equipment against defects in material and workmanship for one (1) year, and provide on-the-premises service during normal working hours for one year, at no cost to purchaser if trouble is not caused by misuse, abuse, or accident, or at current labor rates if so caused. Provide manufacturer's written one-year guarantee for equipment and parts.

B. Service shall normally be available within 24 hours from service department of authorized distributor of manufacturer by factory-trained servicemen.

C. On the premises service at other than normal working hours to also be available, but labor charges for such calls to be paid by purchaser at current labor rates.

D. Alarm contractor shall respond to any emergency repair work on the alarm system, in the one-year period for warranties and guarantees, within two hours, regardless of the hour or day of week.

E. If the alarm contractor fails to respond within two hours, Stockton Unified school District reserves the right to call another vendor to perform the emergency repair, and then back charge the alarm contractor for work performed during this emergency. The District reserves sole right for determination whether repair work is of an emergency nature.

PART 2 DETAIL REQUIREMENTS AND PRODUCTS

2.1 SYSTEM OPERATION

A. Operation of door switches or motion detectors shall transmit alarm signal to District Police Central Station via telephone leased line. Telephone company leased lines shall be arranged by the Owner.

B. The system shall be electrically supervised against open circuits and grounds on the wiring in the system. In addition, wireless devices shall be self-testing and shall report trouble, malfunction, or battery failure to control panel.

2.2 STANDARD PRODUCTS

A. Equipment and accessories furnished under the terms of these specifications shall be the standard products of a single manufacturer. All equipment shall be listed by U.L. and acceptable to the Stockton Unified School District Facilities Planning.

B. INTRUSION ALARM CONTROL PANEL: Control unit shall be surface mounted. This unit shall be mounted in an enamel finished sheet steel cabinet equipped with a hinged door, secured by a lock. Opening main door shall expose all components for inspection or adjustment without further dismantling of the cabinet, control units, or wiring. Ademco Vista-128B or GE Concord 4 shall be the acceptable hard-wired system. System must

be capable of providing nine style-B hardwired zones, support up to 119 zones using built-I polling loop interface, control up to 8 separate partitions, and support 128 wireless zones using a wireless commercial receiver and transmitter.

1. Provide audible trouble signal.

2. Main source system shall operate on a dedicated 120 volt, 60-cycle, AC power unit.

3. **AUXILIARY SOURCE:** Batteries shall be provided to operate the system under supervisory conditions for up to 24 hours after a power failure. Provide separate enclosure similar to control unit construction, if required.

4. Control Panel shall include a minimum of 128 zones.

5. The control panel shall be compatible with District Police Central Station equipment.

6. Control panel shall be keyed to a District Police standard universal key code (provided by the District).

7. Remote wireless devices (when specifically called for on the drawings) must be capable of communication to the control panel from at least 100 yards, or more. Provide appropriate signal repeaters in location to be determined to obtain necessary sensor range.

8. Control panel shall be provided to support 150 user codes with seven authority levels.

C. DETECTORS - Wired Motion Sensors shall be Dual Tec Sensors. Sensors installed that are subject to damage shall include a guard installed over sensor. Dual Tec Motion Sensors shall be used where wireless detectors are required by drawings

D. DOOR SWITCHES -: Recessed and provided with lithium battery.

PART 3 EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Electrical Contractor shall retain the services of the duly appointed representative as specified hereinbefore, who shall furnish all equipment, make all connections to same, and place system in operation. Technician and workman employed shall be particularly skilled in this type of work.

B. Device locations shown on drawings are approximate only. Exact locations shall be field verified in accordance with manufacturer's recommendations. District Facilities Planning or his representative to approve sensor locations when modified from original blueprint locations.

C. Upon completion of installation, six (6) copies of on-line "as-built" wiring diagram shall be furnished to Architect.

D. Each cable run on wiring diagram shall be identified with exact wire marker code (numerical or alphabetical) as appears in terminal cabinets.

E. No splices shall occur in underground pull boxes.

F. The Intrusion Alarm control panels shall be located in a secured utility room.

3.2 PHONE LINES

**A.** The contractor shall coordinate with the District Facilities Planning for telephone line requirements for connection of the control panel to Central Station, and field program the panel and communicator chips.

3.3 CONSTRUCTION MEETINGS

3.3.1 The Contractor shall schedule construction meetings at the jobsite as follows:

3.3.1.1 Pre-roughin meeting shall occur before installation of any boxes raceways, etc.

3.3.1.2 Pre-wire meeting shall occur after raceways are installed and prior to pulling of any wire or cable.

3.3.1.3 Pre-termination meeting shall occur after wire and cable has been installed and prior to termination.

3.3.2 Meetings shall be scheduled by the Contractor on a building-by-building basis and shall include the Project Inspector, School's Representative, the electrical subcontractor, and the Intrusion Alarm System subcontractor as a minimum.

3.4 TESTS

3.4.1 After all equipment specified herein has been installed and is in operating condition, performance tests shall be conducted to verify that installation and components comply with these specifications. Contractor shall furnish competent personnel for this test. Testing shall be scheduled with the Facilities Planning and shall occur after receipt by Architect of Contractor's written certification of completion, record one-line diagram, wiring diagrams, maintenance and operation manuals, and other "As-built" data required by these specifications.

3.4.2 Upon completion of the installation of the intrusion detection and signaling equipment and after satisfactory performance tests have been conducted, a satisfactory demonstration of the entire system shall be made in the presence of the District Facilities Planning and District Police Chief's representative. Contractor shall coordinate with District Police Facilities Planning and School. School shall complete demonstration prior to occupancy.

3.5 KEYS

3.5.1 Provide District with three (3) sets of keys required to operate and maintain system. Keys must be turned over to the District Facilities Planning representative at the final testing by that office before approval and acceptance can be made.

END OF SECTION

# SECTION 28 31 00 – FIRE ALARM INTEGRATED SAFETY SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. General

1. Drawings and conditions of the contract, including but not limited to General Conditions, and the Special Conditions listed below, apply to work of this section.

a. Supplementary Instructions to Bidders.
b. Supplementary Conditions.
c. Summary of the Work.
d. Project Coordination.
e. Cutting and Patching.
f. Definitions and Standards.
g. Submittals.
h. Schedules and Reports.
i. Temporary Facilities.
j. Security Regulations.
k. Safety and Health.
l. Products.
m. Project Closeout.
n. Section 26 05 00, Basic Materials and Methods

B. Project/Work Identification

1. Project Name and Location: ( Identify Here ) Stockton Unified School District. Contract documents indicate the work of the contract, related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the contract documents include, but are not necessarily limited to, the following:

a. Existing site conditions and restrictions.
b. Other work prior to work of contract.
c. Alterations and coordination with existing work.
d. Other work to be performed concurrently by Owner.
e. Other work to be performed concurrently by separate contractors.
f. Other work subsequent to work of Contract.
g. Requirements for occupancy by Owner prior to completion of work of contract.

C. Summary – Fire

1. This performance specification provides the minimum requirements for the Life Safety System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

a. Smoke and fire detection.
b. Sprinkler suppression system monitoring and control.
c. Off-premise notification.
d. Smoke control.
e. Releasing Service
f. Emergency Voice Alarm communication

D. Project representatives

1. All contacts with the Project Building shall be directed to the Owner's Representative, hereafter referred to as the Architect.

E. Interpretation

1. No interpretations of the meaning of the bid documents will be made to any bidder orally. Each request for such interpretation shall be made to the engineer in writing, addressed to the Architect of Record.

2. Written requests for interpretation will be received until 10 days prior to bid date.

F. Manufacturer

1. Acceptable fire alarm system manufacturers include:

2. Edwards Systems – existing fire alarm is EST.

3. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system and smoke control system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

4. The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

G. Alternates – Fire

1. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.

2. The authorized representative of the manufacturer of the major equipment shall be responsible for the satisfactory installation of the complete system.

3. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system, access control, and smoke control.

4. All control panel assemblies and connected field appliances shall be provided by the same system supplier, and shall be designed and tested to ensure that the system operates as specified. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, as described in this specification.

5. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.

6. The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

a. A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.
b. The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.
c. The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

7. The acceptability of any alternate proposed system shall be the sole decision of the Owner or his authorized representative.

1.2 REFERENCES

A. Definitions and abbreviations - general

ADA: Americans with Disabilities Act.
AFF: Above Finished Floor.
AHJ: Authority Having Jurisdiction.
Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.
Circuit: Wire path from a group of devices or appliances to a control panel or transponder.
CPU: The central computer of a multiplex fire alarm or voice command control system.
CRC: Card Reader Controller
CRT: Cathode Ray Tube.
FACP: Fire Alarm Control Panel.
FCC: Fire Command Center.
FSCP: Firefighter's Smoke Control Panel
HVAC: Heating Ventilating and Air Conditioning.
IDC: Initiating Device Circuit.
LED: Light Emitting Diode.
LCD: Liquid Crystal Display.
NFPA: National Fire Protection Association.
NAC: Notification Appliance Circuit.
NCP: Local Network Control Panel.
PTR: Printer.
RCP Remote Control Panel
SLC: Signaling Line Circuit.
Style 1: As defined by NFPA 72, Class B.
Style 4: As defined by NFPA 72, Class B.
Style 6: As defined by NFPA 72, Class A.
Style 7: As defined by NFPA 72, Class A.
Style B: As defined in NFPA 72, Class B.
Style D: As defined in NFPA 72, Class A.

Style Y: As defined in NFPA 72, Class B.
UL or ULI: Underwriters Laboratories, Inc.
UL Listed: Materials or equipment listed and included in the most recent edition of the UL Fire Protection Equipment Directory.
Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

B. Codes – general

1. All work and materials shall conform to all applicable Federal, State and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the Engineer for resolution. National standards shall prevail unless local codes are more stringent. The bidder shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the Engineer.

2. System components proposed in this specification shall be ULI listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment. The supplier shall be responsible for filing of all documents, paying all fees (including, but not limited to plan checking and permit) and securing all permits, inspections and approvals. Upon receipt of approved drawings from the authority having jurisdiction, the supplier shall immediately forward two sets of drawings to the Owner. These drawings shall either be stamped approved or a copy of the letter stating approval shall be included.

C. Codes - fire

1. The equipment and installation shall comply with the current provisions of the following codes and standards:

NFPA 70 – 2016 California Electric Code®
NFPA 72 – 2016 California Fire Alarm Code®
NFPA 90A - 2015 Air Conditioning Systems
NFPA 92A - 2015 Smoke Control Systems
NFPA 92B - 2015 Smoke Management Systems in Malls, Atria, and Large Areas
NFPA 101- 2015 Life Safety Code®
UL 864 - Control Units for Fire Protective Signaling Systems.
UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
UL 268A - Smoke Detectors for Duct Applications.
UL 217 - Single and Multiple Station Smoke Alarms
UL 521 - Heat Detectors for Fire Protective Signaling Systems.
UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
UL 464 - Audible Signaling Appliances.
UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
UL 1971 - Signaling Devices for the Hearing-Impaired.
UL 1481 - Power Supplies for Fire Protective Signaling Systems.
UL 1711 - Amplifiers for Fire Protective Signaling Systems.
UL 1635 - Digital Alarm Communicator System Units

Department of State Architect

California State Fire Marshall

Federal Codes and Regulations

Americans with Disabilities Act (ADA)

Factory Mutual (FM) approval

International Standards Organization (ISO)
ISO-9000
ISO-9001

Electromagnetic Compatibility Requirements

1.3 SYSTEM DESCRIPTION

A. General – fire

1. The fire alarm system is a manual and automatic addressable power-limited fire alarm system. Add new emergency voice communication system for alarm notification.

2. Automatic fire alarm system shall transmit the alarm supervisory and trouble signals to a proprietary supervising station as required by NFPA 72. The supervising station shall be listed as UUKA by Underwriters Laboratory or shall meet the requirements of Factory Mutual Research approval standard 3011. Supervision of system and leased telephone lines shall be arranged by owner.

3. The automatic system shall cover all rooms and areas and upon activation of an initiating device alert all occupants and transmit the alarm, supervisory and trouble signals to an approved supervising station.

4. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional fire alarm system(s). The System(s) shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.

B. It is further intended that upon completion of this work, the Owner be provided with:

1. Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.

2. Complete documentation of system(s) testing.

3. Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is/are in proper working order. Fire Alarm System shall be tested only when the system is 100% complete. Contractor shall use "Fire Alarm System Certification and Description" as required by Section 1-6.2 of NFPA 72 - 2016 edition.

4. Manufacturer supplied training to allow district personnel to access and program Fire Alarm system.

1.4 Description - fire

A. Provide and install a new fire detection and alarm system consisting of:

1. Fire command center shall be located as shown on the drawings.
2. LCD annunciator shall be located as shown on the drawings.
3. Remote control panel(s) shall be located, as shown on the drawings.
4. Manual pull stations shall be located as shown on the drawings.
5. Area smoke detection shall be provided as shown on drawings.
6. Area heat detection shall be provided as shown on drawings.
7. Beam smoke detection shall be located as shown on the drawings
8. Duct smoke detection shall be provided as shown on the drawings.
9. Monitor the sprinkler system waterflow(s) and valve supervisory switch(s).
10. Monitor the stand-alone suppression systems as shown on the drawings.
11. Provide audible appliances located throughout the building(s), as shown on the drawings.
12. Provide synchronized visual appliances located throughout the building, as shown on the drawings.
13. Provide magnetic door holders, as shown on drawings.
14. Provide fan shutdown controls as shown on drawings.
15. Provide elevator recall functions for primary and alternate floors and elevator power shunt trip activation.
16. Provide connection to a Central Station. The owner shall arrange for two dedicated phone lines to be terminated as directed by the installing contractor.

1.5 SEQUENCE OF OPERATIONS

A. General

1. Upon the alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler waterflow, the following functions shall automatically occur:

   a. The internal audible device shall sound at the control panel or command center.
   b. The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.
   c. All system activity/events shall be documented on the system printer.
   d. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
   e. Activate notification audible.
   f. Activate visual strobes notification appliances. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.
   g. Transmit signal to the central station with point identification.
   h. Activate automatic smoke control sequences.

i. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
j. All self-closing fire/smoke doors held open shall be released.
k. Transmit alarm text messages to "alpha-numerical" display pagers.

B. Duct smoke activation – alarm

1. The alarm activation of any duct smoke detector, the following functions shall automatically occur:

a. The internal audible device shall sound at the control panel or command center.
b. The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.
c. All system activity/events shall be documented on the system printer.
d. Any remote or local annunciator LED's associated with the alarm zone shall be illuminated.
e. Transmit signals to remote Annunciators.
f. Transmit signal to the central station with point identification.
g. Shall shutdown the local air-handling unit.
h. Transmit alarm text messages to "alpha-numerical" display pagers.
i. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

C. Supervisory operation

1. Upon supervisory activation of any sprinkler valve supervisory switch, the following functions shall automatically occur:

a. The internal audible device shall sound at the control panel or command center.
b. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
c. All system activity/events shall be documented on the system printer.
d. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
e. Transmit signal to the central station with point identification.

D. Trouble operation

1. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

a. The internal audible device shall sound at the control panel or command center.
b. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
c. All system activity/events shall be documented on the system printer.
d. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
e. Transmit signal to the central station with point identification.

E. Monitor activation

1. Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

a. The internal audible device shall sound at the control panel or command center.

b. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
c. All system activity/events shall be documented on the system printer.
d. Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

1.6 SYSTEM CONFIGURATION

A. General

1. All Life Safety System equipment shall be arranged and programmed to provide the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants.

B. Power supply

1. Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for 24 hours and capable of operating the system for 5 minutes in the alarm mode at 100% load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

C. Display

1. The main display interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermix to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.

D. Initiating device circuits

1. Initiating device circuits monitoring manual fire alarm stations, smoke and heat detectors, waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be Class B (Style "A" or "B").

E. Notification appliance circuits

1. All notification appliance circuits shall be Class B (Style "Y"). All notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 vdc. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

F. Signaling line circuits

1. When a signaling line circuit covers more than one fire/smoke compartment, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments. The signaling line circuit connecting network panel/nodes, annunciators, command centers, shall be Class A (style 7). The media shall be copper except where fiber optic cable is specified on the drawings.

2. The signaling line circuit connecting to addressable/analog devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class B (style 4).

3. The signaling line circuit connecting to the audio communications (pre-amp signal), amplifiers, and nodes shall be Class B (style 4). The circuit shall be power limited.

4. The signaling line circuit connecting to the two-way communications circuit (riser) shall be Class B (style 4).

G. DACT

1. The system shall provide off premise communications capability (DACT) for transmitting system events to multiple Central Monitoring Station (CMS) receivers.

2. The system shall provide an individual CMS account for each tenant, and send the required signals to the one or more CMS(s) and account(s) specified by each tenant. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

3. The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system of the owner’s choice, using TAP Pager protocol.

4. The DACT shall be installed internal to the FACP panel.

5. Coordinate reporting information with district representative.

1.7 SUBMITTALS

A. Project

1. The contractor shall purchase no equipment for the system specified herein until the owner has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit three (3) complete sets of documentation within 30 calendar days after award of purchase order.

2. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.

3. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, and address, date including revisions, and preparer and reviewer's initials.

B. Product data

1. Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Architect/Engineer.

C. Shop drawings

1. A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

    a. Control panel wiring and interconnection schematics.
    b. Complete point-to-point wiring diagrams.
    c. Riser diagrams.
    d. Complete floor plan drawing locating all system devices and 1/4' = 1'-0 scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
    e. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
    f. Complete system bill of material.
    g. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET certification in fire protection engineering technology, subfield of fire alarm systems.

D. Samples

1. A sample of each smoke detector, intelligent modules, horn, strobes, card reader controller, card reader, and door locking mechanism shall be provided to the contractor for their familiarization.

E. Quality assurance /control submittals

1. Installer's Certification

    a. The engineered systems distributor must be licensed in the state of project location and have been incorporated in the business in that state for a minimum of 5 years.
    b. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.

F. System calculations

1. Complete calculations shall be provided which show the electrical load on the following system components:

    a. Each system power supply, including stand alone booster supplies.
    b. Each standby power supply (batteries).
    c. Each notification appliance circuit.
    d. Each auxiliary control circuit that draws power from any system power supply.

G. Close out

1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:

    a. Project specific operating manuals covering the installed integrated life safety system. The manual shall contain a detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. Manufacturer's data sheets and installation manuals/instructions for all equipment

supplied. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

2. As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system. Supply one set of asbuilt drawings, to be installed in lockable print holder (tube style) located at Main FACP, on site.

3. All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.

4. The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).

5. Provide the name, address and telephone of the authorized factory representative.

6. A filled out Record of Completion similar to NFPA 72, 2002 edition figure 10.182.1.1.

7. Provide a detailed test report of the final commissioning of the Fire Alarm System. Report shall include the number of devices installed within each building.

1.8 QUALITY ASSURANCE

A. Qualifications of contractor

1. Fire

a. The contractor shall have successfully installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable size and complexity. The owner reserves the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.
b. The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

B. Pre-installation requirements

1. The provider shall submit a detailed project plan that will describe in detail how the provider will approach the project, from inception to finalization. The plan must include at a minimum the following information:

a. Project Staging
b. Project Management

c. Equipment Schedules
d. Installation Time Lines
e. Other Trade Requirements
f. Final Acceptance Testing
g. Personnel Resumes
h. Progress Report Sample

2. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the manufacturer’s riser/connection diagram and details for all specific system installation/termination/wiring data.

C. Start and completion dates

1. The starting and completion dates for this work will be established at the pre-bid meeting.

1.9 DELIVERY, STORAGE AND HANDLING

A. Receiving and handling

1. The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.

2. Use of loading docks, service driveways, and freight elevators shall be coordinated with the Owner.

1.10 PROJECT CONDITIONS

A. Project conditions

1. It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. Inspection of the building may be made by appointment with the Owner. Contractors are requested to inspect the building prior to the pre-bid meeting.

2. A pre-bid meeting will be held to familiarize the Contractors with the project. Failure to attend the pre-bid meeting may be considered cause for rejection of the Contractor's bid. The minutes of this meeting will be distributed to all attendees and shall constitute an addendum to these specifications.

3. The Contractor shall be responsible for prior coordination of all work and demolition with the Owner.

1.11 WARRANTY AND MAINTENANCE

A. Spare parts – fire

1. The Contractor shall supply the following spare parts:

a. Automatic detection devices - Two (2) percent of the installed quantity of each type.
b. Manual fire alarm stations - Two (2) percent of the installed quantity of each type.
c. Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.
d. Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

B. Warranty

1. The contractor shall warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.

2. The System Supplier shall maintain a service organization with adequate spare parts stock within 25 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the owner notifying the contractor.

1.12 TRAINING

A. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.

B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. FIRE

1. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

2. All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

3. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

2.2 PANEL COMPONENTS & FUNCTIONS

A. GENERAL – FIRE

1. Fire alarm control panel is existing – Edwards System EST, with existing established offsite monitoring as required by the governing codes.

2.3 FIELD MOUNTED SYSTEM COMPONENTS

A. FIRE INITIATING DEVICES

1. ANALOG ADDRESSABLE SMOKE – GENERAL

   a. Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive. In addition to the five sensitivity levels the detector shall provide a pre-alarm sensitivity setting, which shall be settable in 5% increments of the detector's alarm sensitivity value.
   b. An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event. In addition to the five alternate sensitivity levels the detector shall provide an alternate pre-alarm sensitivity setting, which shall be settable in 5% increments of the detector's alternate alarm sensitivity value.
   c. The detector shall be able to differentiate between a long drift above the prealarm threshold and fast rise above the threshold.
   d. The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 75% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% or greater compensation has been used.
   e. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

2. DUCT DETECTOR HOUSING

   a. Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.

3. DUCT DETECTOR MOUNTING PLATE

   a. Where smoke detectors are directly inserted into a low velocity ducts 3 ft (0.91m) high x 3 ft (0.91m) wide, ceiling plenums, or raised floors, provide factory supplied mounting plate assemblies to facilitate mounting the detectors. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish. The detector mounting plate shall support an analog/addressable detector along with a standard, relay or isolator detector-mounting base.

4. SMOKE DETECTOR GUARDS

   a. Smoke detector guards shall be installed at the locations shown on the drawings. The guards shall be Underwriters Laboratories tested and listed by for use with the smoke detectors they protect. Guard design shall not affect the detector operating sensitivity and shall not reduce the listed detector spacing. The guards shall be constructed of

16-gauge steel with a baked white finish to match the detectors. Tamperproof mounting hardware shall be provided.

B. HEAT DETECTORS

1. FIXED TEMPERATURE-ROR HEAT DETECTOR

a. Provide analog/addressable combination fixed temperature / rate-of-rise detectors at the locations shown on the drawings. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications. When installed above ceilings, an identification label visible from the ground shall identify the location of the heat detector.

2. DETECTOR BASE – STANDARD

a. Provide standard detector mounting bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA or 1-gang box. The base shall, contain no electronics and support all series detector types.

2.4 NOTIFICATION APPLIANCES

A. LOW PROFILE SPEAKERS

1. Provide low profile wall mount speakers at the locations shown on the drawings. The speaker shall provide an 84 dBA sound output at 10 ft. when measured in reverberation room per UL-464. The speaker shall have a selectable output. In and out screw terminals shall be provided for wiring. The speaker shall mount in a North American 1-gang box.

B. LOW PROFILE SPEAKER / STROBES

1. Provide low profile wall mount speaker/strobes at the locations shown on the drawings. The speaker/strobe shall provide an audible output of 84 dBA at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide synchronized flash outputs. The strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd & 110cd devices. The speaker shall have a selectable output. In and out screw terminals shall be provided for wiring. Low profile speaker/strobes shall mount in a North American 1-gang box.

C. LOW PROFILE STROBES

1. Provide low profile wall mounted strobes at the locations shown on the drawings. In and out screw terminals shall be provided for wiring. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd, or 110cd devices. Low profile strobes shall mount in a North American 1-gang box.

D. GENERAL

1. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA (AG)), and shall be UL 1971 Listed.

2. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.

3. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended. All strobes shall be provided with lens markings oriented for wall mounting.

4. All notification appliances shall be red unless noted otherwise on the drawings.

2.5 INITIATION & CONTROL MODULES

A. RELAY MODULE

1. Provide addressable control relay circuit modules at the locations shown on the drawings. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware.

B. NOTIFICATION APPLIANCE CIRCUITS

1. Provide addressable notification appliance circuit modules at the locations shown on the drawings. The module shall provide one (1) supervised Class B notification circuit. The module shall provide polarized audible / visual selection for 24Vdc @ 2amps, audio outputs at 25Vrms @ 50 watts or 70 Vrms @ 35 watts.

PART 3 EXECUTION

3.1 INSTALLATION

A. INSTALL SEQUENCE

1. Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed in the following order:

- Riser conduits, AC power conduits and control cabinets.
- Fire command center, remote control panel(s), control component(s), annunciator(s), remote CRT terminal(s), and printer(s). Provide temporary mounting of fire command center in <location.>
- Conduits and wiring for complete notification circuits and appliance installation throughout facility.
- Pre-test the audible and visual notification appliance circuits.
- Install all new detection devices.
- Terminations between field devices and the associated control equipment.
- The detection system shall be switched over and end of each day the system shall be operational. At no time will the system be placed out of service over night.
- Complete the interface to the building automation system.
- Complete contractor pre-test of system.
- Complete system testing.

B. GENERAL

1. All equipment shall be attached to walls and ceiling/floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.

2. Where notification devices or initiation devices are surface mounted, provide manufacturer’s surface backbox.

C. CONDUCTORS

1. The requirement of this section apply to all system conductors, including all signaling line, initiating device, notification appliance, auxiliary function, remote signaling, AC and DC power and grounding/shield drain circuits, and any other wiring installed by the Contractor pursuant to the requirements of these Specifications.

2. All circuits shall be rated power limited in accordance with NEC Article 760.

3. Installed in conduit or enclosed raceway.

4. The existing cable/wiring may be re-used providing they meet the manufacturer's published wiring requirements.

5. All new system conductors shall be of the type(s) specified herein.

6. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.

7. All signaling line circuits, including all addressable initiating device circuits shall be 18 AWG minimum multi-conductor jacketed twisted cable or twisted shielded or as per manufacturer's requirements.

8. All non-addressable initiating device circuits, 24 VDC auxiliary function circuits shall be 18 AWG minimum or per manufacturer's requirements.

9. All notification appliance circuit conductors shall be solid copper or bunch tinned (bonded) stranded copper. Where stranded conductors are utilized, a maximum of 7 strands shall be permitted for No. 16 and No. 18 conductors, and a maximum of 19 strands shall be permitted for No. 14 and larger conductors.

10. All audible notification appliance circuits shall be 14 AWG minimum twisted pairs or twisted pairs shielded or per manufacturer's requirements.

11. All visual notification appliance circuits shall be 14 AWG minimum THHN or twisted pairs or twisted shielded pairs or per manufacturer's requirements.

D. CONDUCTORS AND RACEWAY

1. Except as otherwise required by, the installation of all system circuits shall conform to the requirements of Article 760 and raceway installation to the applicable sections of Chapter 3 of NFPA 70, National Electrical Code. Fire alarm circuit wiring shall include all circuits described in Section 760-1 including Fine Print Note No. 1 (FPN No. 1), and as defined by the manufacturer's UL listing.

2. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices

necessary for the complete installation. All wiring shall be of the type required by the NEC and approved by local authorities having jurisdiction for the purpose.

3. Any shorts, opens, or grounds found on new or existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.

4. The contractor shall neatly tie-wrap all field-wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. All field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except home runs from life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures. No wiring splices shall be permitted in a control panel enclosure.

5. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all local fire codes.

E. CONDUIT RACEWAY

1. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.

2. The requirements of this section apply to all system conduits, raceways, electrical enclosures, junction boxes, pull boxes and device back boxes.

3. All system conduits shall be of the sizes and types specified.

4. All system conduits shall be EMT, 3/4 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.

5. All system conduits shall be installed in accordance with Electrical Specifications Section 16110 and 16010.

6. Conduits shall be sized according to the conductors contained therein. Cross sectional are a percentage fill for system conduits shall not exceed 40%.

7. Provide all new conduit raceway and conduit riser.

8. Existing conduit raceway system may be re-used where possible.

9. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.

10. All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.

11. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.

F. IDENTIFICATION AND LABELS

1. Label each FACP with a printed label that contains the following information:

   - Fire alarm panel number
   - Supply power feed designation

2. Label wires at each device with the designated zone and device number.

3. Submit and affix in a clear folder, to the inside door of the control panel, a plot plan of the site that will identify the following:

   - Location of each fire Alarm Control Panel
   - Location of supply power for each control panel
   - General location of the designated zone as per the FACP programming

3.2 FIELD QUALITY CONTROL

A. TEST & INSPECTION

1. All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.

2. All wiring shall be tested for continuity, shorts, and grounds before the system is activated.

3. All test equipment, instruments, tools and labor required to conduct the tests shall be made available by the installing contractor.

4. The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

5. A final 100% test & inspection shall be performed by a factory trained representative of the system manufacturer only when the system is 100% complete. At the final 100% test and inspection, the representative shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision and participate during all of the testing for the system.

6. All fire alarm testing shall be in accordance with National Fire Alarm Code, NFPA 72 - 2016, Chapter 7.

7. A letter from the Contractor certifying that the system is installed entirely in accordance with the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.

8. The “End of Line Resistance” for each circuit shall be tested in the presence of the project inspector and shall not exceed a maximum of 10% of the 24-volt system. Each component in the circuit shall not exceed the listed manufacturer’s minimum operating voltages. See NFPA 72, Loop resistance. This section requires that all initiating and notification appliance circuits be measured and recorded.

END OF SECTION

# SECTION **31 10 00** - **SITE CLEARING**

## 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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities or abandoning site utilities in place.

B. Related Sections:
1. Section 01 50 00 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
2. Section 01 71 23 "Field Engineering" for field engineering and surveying.
3. Section 02 41 16 "Structure Demolition" for demolition of buildings, structures, and site improvements.

### 1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 REFERENCES

A. Geotechnical Investigation: titled: “Geotechnical Engineering and Geohazards Report, Kennedy Elementary School Classroom Additions, Stockton, California”, prepared by: Terracon, Project No. NA165216 Dated: December 21, 2016.

B. Perform on-site work in accordance with these specifications, City of Stockton Standard Specifications, and CalTrans Standard Specifications.

C. Perform Work within the street right-of-way in accordance with these specifications, City of Stockton Standard Specifications and CalTrans Standard Specifications.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable City, County, State and Federal Regulations and/or codes for environmental requirements, handling and disposal of debris, and use of herbicides.

B. City of Stockton is the jurisdictional agency within the public road/street right-of-ways. An encroachment permit must be obtained from the City of Stockton by the Contractor prior to performing any work within the road/street right-of-ways. The Contractor will be reimbursed by the Owner for the fees associated with the encroachment permit.

1.6 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.7 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.8 QUALITY ASSURANCE

A. Pre-site clearing Conference: Conduct conference at Project site.

1.9 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Contact Underground Service Alert (USA) at 1-800-227-2600 for the locating of existing utilities in the area where the project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. The following practices are prohibited within tree and landscape areas identified to remain unless with written permission from the Owner:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging, unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near tree and landscape areas identified to remain.

G. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

H. The use of explosives and burning on site is prohibited.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.
1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

A. General: Protect trees and plants indentified to remain or to be relocated.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.3 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

B. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Clear site as indicated on drawings.

B. Clear areas required for access to site and execution of work.

C. Grub site as indicated on drawings. At a minimum, grubbing should extend laterally 10 feet outside the limits of the new improvements (i.e., proposed buildings, slabs-on-grade, pavements, etc.). The grubbed material will not be suitable for use as engineered fill.

D. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Tree root systems in proposed construction areas shall be removed to a minimum depth of 2 feet below footing elevation, concrete flatwork and asphalt paving and to such an extent which would permit removal of all roots larger than 1/2 inch in diameter.
   3. Chip removed tree branches and stockpile in areas approved by Owner.

E. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Backfill of tree root excavations shall not be permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proposed control of backfill placement and compaction.
   2. All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials.
   3. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, moisture conditioned (1 to 3 percentage points above the optimum moisture content) as necessary and compact each layer to at least 90 percent of maximum dry density per ASTM D1557.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to a minimum depth of 2 to 4 inches or until all organics in excess of 3 percent by volume are removed. Deeper stripping may be required in localized areas.
   1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

2. The materials removed will not be suitable for Engineered Fill.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

**END OF SECTION 31 10 00**

# SECTION **31 20 00** - **EARTH MOVING**

## 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. Preparing subgrades for slabs-on-grade, walks, plazas, vehicle pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Free draining gravel course for concrete slabs-on-grade.
4. Aggregate base course for concrete walks, plazas and vehicle pavements.
5. Aggregate base course for asphalt paving.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Sections:
1. Section 01 50 00 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Section 03 30 00 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

### 1.3 DEFINITIONS

A. Aggregate Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt or concrete paving.

B. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Building Pad Area: See Sheets A1.9 and A1.11 in the approved plans for the Building Pad Area. Consider revising the term "drainage course" in first paragraph below and throughout this Section to suit Project or office standard. See Evaluations.

F. Free Draining Gravel Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

H. Fill: Soil materials used to raise existing grades.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.4 REFERENCES

A. Geotechnical Investigation: titled: “Geotechnical Engineering and Geohazards Report, Kennedy Elementary School Classroom Additions, Stockton, California”, prepared by: Terracon, Project No. NA165216 Dated: December 21, 2016.

B. Standard Caltrans Specifications, 2015 edition.

C. Perform on-site work in accordance with these specifications, City of Stockton Standard Specifications, and CalTrans Standard Specifications.

D. Perform Work within the street right-of-way in accordance with these specifications, City of Stockton Standard Specifications and CalTrans Standard Specifications.

## 1.5 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Controlled low-strength material, including design mixture.
   2. Warning tapes.

B. Samples: For the following products, in sizes indicated below:
   1. Warning Tape: 12 inches long; of each color.

C. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 1557.

D. Certification: For each borrow soil material proposed for fill and backfill shall be certified by the Contractor and supplier (to the satisfaction of the Owner) that the soils do not contain any environmental contaminates regulated by local, state, or federal agencies having jurisdiction. This certification shall consist of, as minimum, analytical data specific to source of the import material in accordance with the Department of Toxic Substances Control, “Informational Advisory, Clean Imported Fill Material,” dated October 2001.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Contact Underground Service Alert (USA) at 1-800-227-2600 for the locating of existing utilities in the area where the project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 01 50 00 "Temporary Facilities and Controls are in place.

E. The following practices are prohibited within landscape and tree areas identified to remain unless permission is granted by owner:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Heavy Foot traffic.
   4. Erection of temporary sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Prohibit heat sources, flames, ignition sources, and smoking within landscape and tree areas identified to remain.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
   1. Plasticity Index: 10 or less.
   2. Liquid Limit: 30 or less.
   3. Maximum expansion index (ASTM D 4829): 20

4. Minimum Electrical Resistance: 5000 ohms per cubic centimeter (when wetted to any moisture content with distilled water).

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. The on-site clay soils are unsatisfactory for use as engineered fill.
   1. Unsatisfactory soils also include satisfactory soils not maintained at a minimum of 3 percentage points above optimum moisture content at time of compaction as determined by ASTM D1557 test method.

D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; 100 percent passing a 3-inch square, at least 50 percent passing a U.S. No. 4 sieve and at least 20 percent and not more than 40 percent passing a No. 200 sieve. Engineered fill shall be free of rock or gravel larger than 3 inches in any dimension. At least seven days prior to the placement of any fill, the engineer shall be notified of the source of materials. Samples of the proposed fill shall be obtained to determine the suitability of the materials for use as engineered fill.
   1. Plasticity Index: 10 or less.
   2. Liquid Limit: 30 or less.
   3. Maximum expansion index (ASTM D 4829): 20
   4. Minimum Electrical Resistance: 5000 ohms per cubic centimeter (when wetted to any moisture content with distilled water).

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Class 2 Aggregate Base Course: Clean mixture of 3/4-inch natural or crushed gravel, crushed stone, and natural or crushed sand complying with Caltrans Standard Specification, Section 26, Class 2.

G. Free Draining Gravel Course: Clean mixture of 3/4-inch crushed rock, No. 4 x 3/4-inch gravel, or permeable aggregate complying with Caltrans Standard Specification, Section 68, Class 1, Type B.

H. Sand: ASTM C 33; fine aggregate.

## 2.2 CONTROLLED LOW-STRENGTH MATERIAL (CDF)

A. Controlled Low-Strength Material (CDF): Self-compacting, low-density, flowable concrete material produced from the following:
   1. Portland Cement: ASTM C 150, Type II.
   2. Fly Ash: ASTM C 618, Class C or F. The fly ash shall not inhibit the entrainment of air.
   3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
   4. Water: ASTM C 94.
   5. Air-Entraining Admixture: ASTM C 260. Air entrainment shall not exceed 20 percent.

B. Produce conventional-weight, controlled low-strength material with 80-psi to 140-psi compressive strength when tested according to ASTM C 495.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 4 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Water: Potable water free from oil and shall contain no more than 650 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as $SO_4$. The water shall not contain an amount of impurities that will cause a reduction in the strength of the stabilized material.

C. Curing Seal: CalTrans Section 94, Grade SS1, SS1h, CSS1, or CSS1h.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Excavate to lines and levels required for construction of the work indicated on the drawings.

B. Replace damaged or displaced subsoil to same requirements as for specified fill.

C. Prevent displacement or loose material from falling into excavation, maintain soil stability. Comply with the requirements of Title 8, CCR, Sections 1539 – 1543.

D. Grade top perimeter of excavation to prevent surface water from draining into excavation.

E. Clay, silt, and sand soils along with cemented soils were encountered in the Geotechnical Test Borings and Pits. Conventional excavating equipment for the area may be utilized. Slower excavation should be anticipated in the hard clay/silt and cemented soils. The contractor shall plan his work accordingly.

F. Notify Owner's Representative of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

G. Stockpile excavated material in area designated on site. Remove excess or unsuitable material from site or stockpile on site as directed. Contractor shall work with the school district and the site to determine the best location for stockpiling of excavated material.

3.5 EXCAVATION FOR STRUCTURES (BUILDING PAD AREA)

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

B. Underpin adjacent structures, which may be damaged by excavating work.

C. Excavate subsoil to accommodate site structure foundations and slabs-on-grade.

D. Footings shall bear on 18 inches minimum non-expansive engineered fill. Over-excavation for non-expansive engineered fill placement below footings shall extend laterally beyond all edges of the footings at least 8 inches per foot of over-excavation depth below footing base elevation. Footings for walls shall be a minimum of 12 inches wide and shall have a minimum depth of 24 inches below lowest surrounding grade. Footings for columns shall be a minimum of 24 inches wide and shall have a minimum depth of 24 inches below lowest surrounding grade. When footings are located adjacent to trenches, the bottom of such footings should be at least 1 foot below an imaginary plane with an inclination of 1.5 horizontal to 1.0 vertical extending upward from the nearest bottom edge of the adjacent trench. **Over-excavation depth shall be 54 inches minimum below top of finished floor slab**.

E. Voids resulting from the removal of any buried structures (such as irrigation structures or pipes, foundations, tanks, septic systems, sewer lines, water lines and storm drain lines) should be cleared of all loose soil and debris so that they may be backfilled during filling operations.

3.6 EXCAVATION FOR WALKS, PLAZAS AND VEHICLE PAVEMENTS

A. Excavate surfaces under walks, plazas and vehicle pavements to indicated lines, cross sections, elevations, and subgrades.

B. Over-excavate at the proposed walks and exterior slabs on grade (sidewalks and exterior slabs on grade that are not directly attached to the new building and are outside the building pad area) at a minimum to the bottom of the 6-inch class 2 aggregate base section (11 inches below top of finished walk or exterior slab on grade.)

C. Over-excavate at the proposed asphalt paving areas at a minimum to the bottom of the 10-inch class 2 aggregate base section (13 inches below top of finished asphalt paving.)

D. Over-excavate at the proposed fire lane paving areas at a minimum to the bottom of the 13-inch class 2 aggregate base section (16 1/2 inches below top of finished asphalt paving.)

## 3.7 EXCAVATION FOR UTILITY TRENCHES

A. Comply with Title 8, CCR, Sections 1539 through 1541.

B. The soils encountered at the site are classified as Type A (Clay and Silt) and Type C (sand) soils.

C. Excavate trenches to indicated gradients, lines, depths, and elevations.

D. For trenches less than 5’-0” deep, the general contractor, at time of trenching, shall have the soil examined by a competent person to determine soil stability; unstable sidewalls shall be shored or sloped.

E. For trenches 5’-0” or deeper, the general contractor, in advance of excavation, shall secure a permit through the Division of Occupational Safety and Health. The contractor shall submit a detailed plan showing the design of shoring for protection from the hazard of caving ground during the excavation of such trench or trenches to the School District through the Architect.

F. When sloping of sidewalls is employed the following slopes shall be followed for the soil type:
   1. Type A soils:Maximum slope of 3/4H:1V (horizontal to vertical) for excavations less than 20 feet deep.
   2. Type C soils: Maximum slope of 1 1/2H:1V (horizontal to vertical) for excavations less than 20 feet deep.

G. Excavate trenches to uniform widths (unless otherwise prohibited) to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 6 inches each side of pipe or conduit.

H. Trench Bottoms: Excavate trenches 6 inches deeper (minimum) than bottom of pipe and conduit elevations to allow for bedding course. Hand excavate deeper for bells of pipe.

## 3.8 SUBGRADE INSPECTION

A. Notify Architect and Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of bedding material to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil and/or engineered fill (the upper 18 inches of the building pad beneath the slab) to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill (the upper 18 inches of the building pad beneath the slab) of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

## 3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations of subgrade as follows:
1. Under grass and planted areas, use native soil.
2. Under walks and pavements in building pad area, use engineered fill.
3. Under walks and pavements outside of building pad area use native soil.
4. Under steps and ramps in building pad area, use engineered fill.
5. Under steps and ramps outside of building pad area, use native soil.
6. Under building slabs, use engineered fill.
7. Under footings and foundations, use engineered fill.

C. No fill shall be placed during weather conditions which will alter the moisture content of the fill materials sufficiently to make adequate compaction impossible. After placing operations have been stopped because of adverse weather conditions, no additional fill material shall be placed until the last layer compacted has been checked and found to be compacted to the specified densities.

## 3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction in the following range above optimum moisture content as determined in the ASTM D1557 test method.
1. Import non-expansive engineered fill soils:
2. a.Beneath foundations: +1 percent minimum to +4 percent maximum
3. b. Beneath slabs: +1 percent minimum to +4 percent maximum
4. c. Utility trenches: +1 percent minimum to +3 percent maximum
5. On-site clayey soils:
6. a.Bottom of excavation receiving fill: +2 percent minimum to +4 percent maximum
7. b.Miscellaneous backfill: +2 percent minimum to +4 percent maximum
8. c. Utility trenches: +2 percent minimum to +4 percent maximum
9. d.Beneath asphalt pavement: +2 percent minimum to +3 percent maximum
10. e.Beneath concrete pavements: + 2 percent minimum to +3 percent maximum
11. Aggregate base and Subbase (beneath pavements): +1 percent minimum to +3 percent maximum.

12. The optimum moisture content will be determined by the Geotechnical Engineer, who will supply this information to the contractor.
13. The moisture conditioning of the subgrade is highly dependent on the time of year of construction. The Geotechnical Engineer shall be present to observe the exposed sugrade and will specify the moisture conditioning required for the subgrade.
14. If necessary to obtain uniform distribution of moisture, water shall be added to each layer by sprinkling and the soil disked, harrowed, or otherwise manipulated after the water is added.
15. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
16. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that is too wet to compact to specified dry unit weight.

B. The subgrade of exterior concrete flatwork or sidewalks that are not adjacent to the buildings and do not utilize 18 inches of engineered fill should be in a moistened condition for a minimum depth of 18 inches prior to Class 2 Aggregate Base placement.

## 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. The maximum dry density will be determined by the Geotechnical Engineer, who will supply this information to the contractor.

D. Compact soil materials to not less than the following percentages of maximum dry density according to ASTM D 1557:
1. The depth of scarification of native soils of the subgrade is highly dependent on the time of year. The Geotechnical Engineer shall be present to observe the exposed subgrade and specify the depth of scarification required. **Note: The depth of scarification listed below is for bidding purposes.**
2. Scarification of the subgrade is required where native or imported soil is placed to raise existing grade for proposed building pad and other site improvements.
3. Under structures, building slabs, and steps, scarify and recompact top 12 inches (minimum) of existing subgrade and each layer of backfill or fill soil material at 90 percent relative compaction.
4. Under asphalt and concrete vehicle pavements (not walkways and plazas), scarify and recompact top 12 inches (minimum) of existing subgrade and each layer of backfill or fill soil material at 95 percent relative compaction.
5. Under concrete walkways and plazas (Building Pad Area), scarify and recompact top 12 inches (minimum) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
6. Under concrete walkways and plazas (outside Building Pad Area and the project requires fill to establish new grades), scarify and recompact top 12 inches (minimum) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
7. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
8. For utility trenches not in vehicle pavement areas, compact each layer of initial and final backfill soil material at 90 percent.

9. For utility trenches within vehicle pavement areas, compact each layer of initial backfill soil material at 90 percent and compact the upper 8 inches of backfill to at least 95 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 CLASS 2 AGGREGATE BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place class 2 aggregate base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place class 2 aggregate base course under pavements and walks as follows:
   1. Shape base course to required crown elevations and cross-slope grades.
   2. Place base course 6 inches or less in compacted thickness in a single layer.
   3. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry density with a minimum moisture content of at least optimum as obtainable by the ASTM D 1557 test method.

3.18 FREE DRAINING GRAVEL COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place free draining gravel course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact free draining gravel course under cast-in-place concrete slabs-on-grade as follows:
   1. Place free draining gravel course 6 inches or less in compacted thickness in a single layer.
   2. Compact free draining gravel course to not less than 90 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

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

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Geotechnical Engineer.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

## 3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

## 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, lime treated spoils, trash, and debris, and legally dispose of them off Owner's property.

**END OF SECTION 31 20 00**

# SECTION **31 50 00** - **EXCAVATION SUPPORT AND PROTECTION**

## 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 temporary excavation support and protection systems.

B. Related Sections:
   1. Section 01 50 00 "Temporary Facilities and Controls" for temporary utilities and support facilities.

### 1.3 REFERENCES

A. Geotechnical Investigation: titled: “Geotechnical Engineering and Geohazards Report, Kennedy Elementary School Classroom Additions, Stockton, California”, prepared by: Terracon, Project No. NA165216 Dated: December 21, 2016.

B. Perform on-site work in accordance with these specifications, City of Stockton Standard Specifications, and CalTrans Standard Specifications.

### 1.4 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
   1. Work shall conform to the requirements of Cal-OSHA.
   2. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a California Registered Civil Engineer, using performance requirements and design criteria indicated.
   3. Prevent surface water from entering excavations by grading, dikes, or other means.
   4. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
   5. Monitor vibrations, settlements, and movements.

### 1.5 SUBMITTALS

A. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and stamped by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For qualified California Registered Land Surveyor and California Registered Civil Engineer.

C. Other Informational Submittals:
   1. Photographs or Video: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
   2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
      a. Note locations and capping depth of wells and well points.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify Owner no fewer than three days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
   1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
   1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 None

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
   1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

## 3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

## 3.3 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
   2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

## 3.4 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
   2. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 "Earth Moving."
   3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

**END OF SECTION 31 50 00**

# SECTION **32 12 16** - **ASPHALT PAVING**

## 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. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.

B. Related Requirements:
   1. Section 02 41 16 "Structure Demolition" for demolition and removal of existing asphalt pavement.
   2. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, and unbound-aggregate subbase and base courses.
   3. Section 32 17 23 “Pavement Markings” for application of pavement markings on asphalt concrete paving.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: For each job mix proposed for the Work.

B. Qualification Data: For manufacturer.

C. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

D. Material Test Reports: For each paving material, by a qualified testing agency.

### 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by CalTrans.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the City of Stockton, California and CalTrans for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
   5. Single Course (3 inch minimum): Minimum surface temperature of 50 deg F and rising with a minimum atmospheric temperature of 45 deg F and rising at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. In accordance with CalTrans Section 39:
   1. Single or Top Layer: 1/2 inch maximum, medium, Type A.
   2. Lower Layer: 3/4 inch maximum, coarse, Type A.
   3. Reclaimed asphalt pavement (RAP) may be used as aggregate for a part of the virgin aggregate in the asphalt paving in a quantity not exceeding 15 percent of the aggregate blend.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320, PG 64-10.

B. Asphalt Cement: ASTM D 3381/D 3381M for viscosity-graded material.

C. Cutback Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-250.

D. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141; pumping consistency.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement and reclaimed, unbound-aggregate base material from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the California EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: AASHTO M 29, Grade No. 2 or No. 3.

D. Joint Sealant: AASHTO M 324, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and in suitable condition to begin paving.

B. Verify that compacted subgrade is ready to support paving and imposed loads.

C. Verify that gradients and elevations of base are correct.

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

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Re-compact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.150.10 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

3.4 B.Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

A. 1.Mix herbicide with prime coat if formulated by manufacturer for that purpose.

B. 2.Coordinate treatment application with School District personnel. Provide School District a minimum of 72 hour advance notice before application to allow time for notification of parents and staff.

3.5 C.Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

3.6 1.If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

3.7 2. Protect primed substrate from damage until ready to receive paving.

3.8 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated on approved drawings.
   2. Place hot-mix asphalt surface course in single lift.
   3. Spread mix at a minimum temperature of 250 deg F.
   4. Begin applying mix on high side of one-way slopes unless otherwise indicated.
   5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.10 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Single Course or Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Single Course or Surface Course: 1/8 inch.

3.12 FIELD QUALITY CONTROL

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

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures according to AASHTO T 168.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

**END OF SECTION 32 12 16**

# SECTION **32 13 13** - **CONCRETE PAVING**

## 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. Curbs and gutters.
2. Walks.

B. Related Sections:
1. Section 03 30 00 "Cast-in-Place Concrete for general building applications of concrete.
2. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and adjacent construction.

### 1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

### 1.4 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Qualification Data: For installer and Design Mixture Engineer (California Registered Civil or Structural Engineer).

E. Material Certificates: Certificates shall be signed by manufacturers and contractor certifying that each material complies with, or exceeds specified requirements for the following:
1. Cementitious materials.
2. Aggregates.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Joint fillers.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.

1. California Building Code - Title 24, Part 2, CCR-2016 Edition with State of California Amendments.

2. ACI 301 "Specifications for Structural Concrete for Buildings." A registered civil engineer with experience in concrete mix design shall select the relative amounts of ingredients to be used as basic proportions of the concrete mixes proposed for use under CBC Section 1905A.2 and testing shall be performed in a laboratory acceptable to the enforcement agency.

3. ACI 318 "Building Code Requirements for Reinforced Concrete."

4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

C. Concrete Testing Service: The Owner shall employ a testing laboratory acceptable to the Architect to perform material evaluation tests. Design of concrete mixes shall be by a registered civil engineer retained by the Contractor.
1. Materials and installed work may require testing and retesting, as directed by the Architect, at anytime during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at Owner's expense, including re-testing of rejected materials and installed work, shall be paid by Owner, but backcharged to the Contractor.
2. Testing shall be performed per Section 3.11 of these Specifications and Chapter 19A, Title 24

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

## 2.2 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

C. Reinforcing Bars: ASTM A 615, Grade 60 for #4 and larger, and ASTM A615, Grade 40 for #3 and smaller ; deformed.

D. Plain-Steel Wire: ASTM A 82, cold drawn.

E. Deformed-Steel Wire: ASTM A 496.

F. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

G. Slip Dowel System: Greenstreak two component Speed Dowel System to accept #4 x 12” to 24” long slip dowels (see drawings for size at specific details.) The Greenstreak Speed Dowel System is comprised of a reusable base and a plastic sleeve. Both pieces shall be manufactured from polypropylene plastic.

H. Tie Bars: ASTM A 615, Grade 60 for #4 and larger, and ASTM A615, Grade 40 for #3 and smaller, deformed.

I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, gray portland cement Type II

B. Normal-Weight Aggregates and Exposed Aggregate: ASTM C 33, Class 1N, uniformly graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94.

## 2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

## 2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

## 2.6 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, as specified in ACI 301 and Chapter 5 of ACI 318.
   1. Use a qualified independent testing agency, acceptable to Architect, for preparing and reporting proposed mixture designs based on laboratory trial mixtures. The testing shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
   2. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

B. Adjustment to Concrete Mixes: Mix design adjustment may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and approved by Architect before using in work.

C. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 2500 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.60.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
   4. Air Content: Plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

## 2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.
   1. Delete references for allowing additional water to be added to batch for material with sufficient slump. Addition of water to the batch will not be permitted.
   2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

3. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that compacted subgrade, granular base is dry and in suitable condition to begin paving.

B. Verify that compacted subgrade, granular base is ready to support paving and imposed loads.

C. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

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

### 3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Assemble formwork to permit easy stripping and dismantling of without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

D. Clean forms and adjacent surface to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

E. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Set wire ties with ends directed into concrete,

not toward exposed concrete surfaces. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints, score lines, and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Slip Doweled Joints (Speed Dowel System): Install dowel bars and support assemblies at joints where indicated.
      a. Attach Speed Dowel System bases to the face of the concrete forms using a double headed nail or self-tapping screw.
      b. Center of Speed Dowel System base shall be centered on form. Place edge forms plumb. Out of plumb forms will result in misaligned dowels.
      c. Prior to pouring concrete, Speed Dowel System sleeve shall be slipped over Speed Dowel System base.
      d. Pour concrete minimum of 18” from Speed Dowel System and work concrete around the Speed Dowel System. Concrete shall not be poured directly over the Speed Dowel System.
      e. Concrete forms shall be removed with Speed Dowel System bases still attached. Speed Dowel System bases may be reused.
      f. Install slip dowels to the full depth of the embedded Speed Dowel System sleeve and proceed with next concrete pour. Greasing of dowels is not required as the embedded Speed Dowel System sleeve accommodates expansion and shrinkage movements that may occur. Bent or badly sheared slip dowels shall not be used. Saw cut dowels recommended.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of no more than 30 feet unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Control Joints: Form weakened-plane control joints, alternating with score lines and sectioning the concrete into areas as indicated. Construct weakened-plane joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.

E. Score Lines: Form score lines, alternating with weakened-plane joints and sectioning the concrete into areas as indicated. Construct score lines for a depth as indicated, as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes.

F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove ice or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

K. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## 3.7 FLOAT FINISHING (TYPE 1 FINISH - SEE SITE PLANS)

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface to provide a uniform, fine-line texture.
   a. Curbs and Gutters.
2. Medium-Textured Broom Finish: Draw a stiff-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, medium-line texture.
   a. Sidewalk Paving: Slopes less than 6%.
   b. Gutters in Path of Travel: Slopes less than 6%.
3. Heavy-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
   a. Sidewalk Paving: Slopes of 6% or greater.
   b. Gutters in Path of Travel: Slopes of 6% or greater.

## 3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

## 3.9 TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 1/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch.
   6. Vertical Alignment of Dowels: 1/4 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
   8. Joint Spacing: 3 inches.
   9. Weakened-plane Joint Depth: Plus 1/4 inch, no minus.
   10. Joint Width: Plus 1/8 inch, no minus.

## 3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing laboratory to perform field tests and prepare test reports. Refer to the DSA-103 Structural Tests and Inspections Form at the end of Section 01 40 00 - Quality Control.

B. Waiver of Batch Plant Inspection: Batch plant inspection may be waived under the following condition:
   1. The concrete plan complies fully with the requirements of ASTM C94, Sections 8 and 9, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to DSA. The certification shall indicate that the plant has automatic batching and recording capabilities.
   2. When batch plant inspection is waived the following requirements shall apply:
      a. An approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weighmaster.
      b. The licensed weighmaster shall positively identify materials as to quantity and certify each load by a ticket.
      c. The ticket shall be transmitted to the project inspector by a truck driver with load identified thereon. The inspector will not accept the load without a load ticket identifying the mix. The inspector will keep a daily record of placements, identifying each truck, its load and time of receipt, and approximate location of deposit in the structure. The inspector will transmit a copy of the daily record to DSA.

d. At the end of the project, the weighmaster shall furnish an affidavit to DSA on form SSS 411-8 certifying that all concrete furnished conforms in every particular to the proportions established by mix designs.

C. Testing Services: Testing of composite samples of fresh concrete obtained according to CBC Section 1905A.6 and ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and one specimen at 28 days.

D. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

E. Test results shall be reported in writing to Architect, DSA, concrete batch plant, and Contractor on same day that tests are made. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

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

I. Prepare test and inspection reports.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

**END OF SECTION 32 13 13**

# SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

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. Cold-applied joint sealants.
2. Joint-sealant backer materials.
3. Primers.

B. Related Requirements:
1. Section 07 92 00 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Installation Instructions: Manufacturer's written installation instructions for products and applications indicated for each joint-sealant product.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Paving-Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

E. Qualification Data: For Installer.

F. Product Certificates: For each type of joint sealant and accessory.

1.4 QUALITY ASSURANCE

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

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions.

Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of joint-sealant backings.
   2. Do not stretch, twist, puncture, or tear joint-sealant backings.
   3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
   1. Place joint sealants so they fully contact joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving (**PJS-1)**.
   1. Joint Location:
      a. Expansion and isolation joints in concrete paving.
      b. Contraction joints in concrete paving.
      c. Other joints as indicated.
   2. Joint Sealant: Single-component, self-leveling, silicone joint sealant.
   3. Joint-Sealant Color: Manufacturer's standard.

**END OF SECTION 32 13 73**

# SECTION 32 17 23 - PAVEMENT MARKINGS

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 painted markings applied to asphalt pavement.

1.3 SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.
   1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
   2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Ennis-Flint; **EF Series Fast Dry** or a comparable product by one of the following:
   1. Aexcel Inc.
   2. PPG Industries.
   3. Rodda Paint Co.

2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
   1. Colors: White and Blue as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 14 days before starting pavement marking. Place an inconspicuous test stripe to determine if new asphalt surface has cured sufficiently to allow placement of pavement markings. If the asphalt lifts or cracks during the curing of the test paint film, the asphalt has not cured sufficiently to allow placement of the pavement markings.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

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

**END OF SECTION 32 17 23**

# SECTION 32 17 26 - TACTILE WARNING SURFACING

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. Cast-in-place detectable warning tiles.
2. Surface-applied detectable warning tiles.

B. Related Requirements:
1. Section 32 12 16 “Asphalt Paving” for asphalt paving serving as substrates for tactile warning surfacing.
2. Section 32 13 13 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:
1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:
1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Deterioration of finishes beyond normal weathering and wear.
b. Separation or delamination of materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in Chapter 11B of the 2016 California Building Code for tactile warning surfaces.
1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, joint material, setting material, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
1. Basis-of-Design Product: Subject to compliance with requirements, provide East Jordan Iron Works: DURALAST Detectable Warning Plate, California Edition. (Drawings Mark) **ADA-C**.
2. Material: Cast Iron ASTM A48, Class 35 B and/or AASHTO M105, Class 35B gray iron and/or ASTM A536 Ductile Iron. Castings must contain a minimum of 85% recycled content.
3. Color: Shall be finished uncoated to allow material to develop a Rust Red Patina
4. Shapes and Sizes:
a. Rectangular panels as indicated on approved drawings.
5. Dome Spacing and Configuration: 2.35-inch spacing, in square pattern.
6. Mounting:
a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

B. Surface-Applied Detectable Warning Tiles: Accessible truncated-dome detectable warning concrete tiles configured for surface application on existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of tile, and beveled outside edges.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Engineered Plastics Inc.; Armor-Tile; (Drawings Mark) **ADA-S**.
2. Material: Vitrified polymer composite.
3. Color: Federal Yellow (Federal Color No. 33538).
4. Shapes and Sizes:
a. Rectangular panels as indicated on the approved drawings.

5. Dome Spacing and Configuration: 2.35-inch spacing, in square pattern.
6. Mounting: Adhered and fastened to existing concrete or new asphalt surface.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
   1. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.

C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

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

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of Chapter 11B of the 2016 California Building Code.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:
   1. Concrete Paving Installation: Comply with installation requirements in Section 32 13 13 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
   2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping with rubber mallet until concrete seeps through vent holes.
   3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
   4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
   5. Clean tiles using methods recommended in writing by manufacturer.

B. Surface-Applied Detectable Warning Tiles:
   1. Lay out detectable warning tiles as indicated and mark concrete pavement.

2. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.
3. Apply adhesive to back of tiles in amounts and pattern recommended by manufacturer, and set tiles in place. Firmly seat tiles in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
4. Install anchor devices through face of tiles and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with top surface of mat.
5. Mask perimeter of tiles and adjacent concrete, and apply sealant in continuous bead around perimeter of tile installation.
6. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning tiles and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
7. Protect installed tiles from traffic until adhesive has set.

3.4 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

# SECTION **32 18 16.13** - **PLAYGROUND PROTECTIVE SURFACING**

## 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. Unitary synthetic rubber tile surface.

B. Related Sections:
   1. Section 33 41 00 "Storm Drain System" for playground subdrainage system.

### 1.3 DEFINITIONS

A. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

B. SBR: Styrene-butadiene rubber.

### 1.4 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: According to ASTM F 1292.

B. Accessibility of Surface Systems: According to ASTM F 1951 and CCR Title 24 California Accessibility Standards as administered and enforced by the Division of the State Architect (DSA).

### 1.5 SUBMITTALS

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

B. Shop Drawings: For each playground surface system, include materials, plans, cross sections, drainage, installation, and penetration details.

C. Samples for Initial Selection: For each type of playground surface system indicated.
   1. Include similar Samples of playground surface system and accessories involving color selection.

D. Samples for Verification: For each type of playground surface system indicated.
   1. Minimum 6-by-6-inch Sample of synthetic rubber tile surface.

E. 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. Extent of surface systems and use zones for equipment.
   2. Critical heights for playground surfaces and fall heights for equipment.

F. Qualification Data: For qualified Installer.

G. Product Certificates: For each type of unitary synthetic playground surface system, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each unitary synthetic playground surface system.

I. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground surface system to include in 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. Deliver extra materials to owner where directed. Obtain signed receipt from owner that indicate where materials were delivered, the date of delivery, who accepted delivery and the amount and nature of materials delivered. Include copy of signed receipt in maintenance manuals.
   1. Synthetic Tile Units: Full-size units equal to 1 percent of amount installed, but no fewer than 3 units.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain playground surface system materials from single source from single manufacturer.
   1. Provide secondary materials including adhesives, primers, and repair materials of type and from source recommended by manufacturer of playground surface system materials.

C. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system installation to be performed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground surface system that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Reduction in impact attenuation.
      b. Deterioration of surface and other materials beyond normal weathering.
   2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 UNITARY SYNTHETIC TILE SURFACE

A. Tile System: Manufacturer's standard blend of recycled SBR, EPDM rubber, or PVC particles forming an integral wearing course and cushion course, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951 and CCR Title 24 Accessibility Standards as administered and enforced by the Division of the State Architect (DSA).
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Little Tikes Commercial, Inc.; Kid Tiles or comparable product by one of the following:
      a. Ecore International; PlayGuard Pigmented Tiles.
      b. Mitchell Rubber Products, Inc.; E-Z Fall.
      c. North West Rubber Ltd.; Playfall.
      d. No Fault Sport Group, LLC; Safety Tile.
      e. OTS Company; G-Flex.
      f. Safe Guard Surfacing Corp.; Pre-formed Tiles.
      g. SpectraTurf, Inc.; SpectraBound.
   2. Unit Size: 24 by 24 inches.
   3. Base Profile: With integral ribbed or grid-patterned underside forming channels for water drainage between surface and substrate.
   4. Critical Height: 8 Feet.
   5. Overall Thickness: 3.5 inches (for basis of design product); otherwise, not less than as required for critical height indicated.
   6. Anchor Cement: Manufacturer's standard nonshrink grout or polymer resin.
   7. Tile Color(s): As selected by Architect from manufacturer's full range.
      a. Color Pattern: As indicated on Drawings.
   8. Filler/Sealant: Manufacturer's standard clear silicone or polyurethane filler/sealant suitable for exterior use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, and other conditions affecting performance of the Work.

B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary playground surface system installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to playground surface system manufacturer's written requirements for cross-section profile.
   1. Concrete Substrates: Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by playground surface system manufacturer.

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

3.2 PREPARATION

A. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Concrete Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
   1. Repair unsatisfactory surfaces and fill holes and depressions.
   2. Mechanically scarify or otherwise prepare concrete substrates to achieve recommended degree of roughness.
   3. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through playground surface system.

3.3 INSTALLATION, GENERAL

A. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.

3.4 INSTALLATION OF TILE PLAYGROUND SURFACE SYSTEMS

A. Tile Units: Provide a uniform wearing surface with no unaligned units, raised edges, or surface imperfections.
   1. Lay out units from center marks established with principal perimeter edges, discounting minor offsets, so units at opposite edges of installation are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a unit at perimeter. Allow for border edge.
      a. Alignment Axis and Pattern: Lay units square with playground equipment axis. Lay units in straight-line grid pattern with joints aligned.
   2. Cut and fit units around playground equipment supports and vertical surfaces. Do not create voids greater than 3/8 inch wide.
      a. Do not stretch units during installation.
   3. Adhesively Applied Units: Adhere units to substrates using a full spread of adhesive applied to substrate or to unit.
   4. Filler/Sealant: Mask area surrounding cutouts around playground equipment supports and other obstructions. Apply a full bead of filler/sealant, filling cutouts immediately after laying tile with cutout.

3.5 FIELD QUALITY CONTROL

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

B. Testing Services: Testing and inspecting of completed applications of playground surface system shall take place according to ASTM F 1292.

C. Remove and replace applications of playground surface system where test results indicate that it does not comply with requirements.

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

3.6 PROTECTION

A. Tile Systems: Prevent traffic over system for not less than 48 hours after installation.

**END OF SECTION 32 18 16.13**

# SECTION 32 31 13 – CHAIN LINK FENCING AND GATES:

1. GENERAL:

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of chain link fences and gates is indicted on drawings.

1.3 QUALITY ASSURANCE:

Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

B. Shop Drawings: Submit shop drawings indicating extent, type gate locations and post footing details.

2. PRODUCTS:

2.1 GENERAL: Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.

2.2 MANUFACTURER: Subject to compliance with requirement, provide products of one of the following:

A. Galvanized Steel Fencing and Fabric: Equal to:
   1. United States Steel Corp.
   2. Anchor Fence, Inc.
   3. Master-Holco Co.

2.3 STEEL FABRIC:

A. Fabric: No 9 gauge (0.148" + or – 0.005") size steel wires, 2" mesh, with top salvages knuckled for fabric 60" high and under, and both top and bottom salvages twisted and barbed for fabric over 60" high.

B. Furnish one piece fabric widths for fencing up to 12' high.

C. Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz. Zinc per sq. ft of surface.

2.4 FRAMING AND ACCESSORIES:

A. Steel Framework General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. Zinc per sq. ft. of surface.

B. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table 1.

C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated of following minimum sizes and weights.

1. 6' to 8' fabric height 2.375" OD steel pipe, 3.65 lbs. per lin. ft.

2. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft.

2.5 GATE POSTS: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

| LEAF WIDTH | GATE POST | LBS./LIN. FT. |
|---|---|---|
| Up to 6' | 3.5 "x 3.5" roll-formed Section | 4.85 |
| | or 2.875: OD pipe | 5.79 |
| Over 6' to 13' | 4.000 OD pipe | 9.11 |
| Over 13' to 18' | 6.625 OD pipe | 18.97 |
| Over 18' | 8.625 OD pipe | 28.55 |

2.6 TOP RAIL: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end.

A. 1.66" OD pipe, 2.27 lbs. per ft.

B. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

2.7 POST TOPS: Provide weathertight closure cap with loop to receive tension wire or toprail; one cap for each post.

2.8 STRETCHER BARS: One piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3.4". Provide one stretcher bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.

2.9 STRETCHER BAR BANDS: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

2.10 MAINTENANCE GATES:

A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate ramp at not more than 15" o.c. Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.

C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1 ½" pair of hinges for each leaf over 6' nominal height.

2. Latch: Forked type or plunger bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

a. Except gates with Panic Hardware.

D Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

E. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

2.11 PEDESTRIAN GATES:

A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8' apart unless otherwise indicated.

Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate ramp at not more than 15" o.c. Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.

C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1 ½" pair of hinges for each leaf over 6' nominal height.

2. Panic Device: Corbin Russwin ED8200 (Nightlatch function) w/ P857 Wing Pull. Provide Schlage Primus Keyways per Section 08 71 00 – Finish Hardware. Manual cane bolts are prohibited on leaf with panic device.

3. Kickplate: Provide 10” high galvanized steel kickplate on both sides of gate.

2.13 CONCRETE:

Provide concrete consisting of portland cement, ASTM C 150, aggregate ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28 day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1” maximum size aggregate, maximum 3” slump, and 2% to 4% entrained air.

2.14 DECORATIVE INSERTS (where called for on approved drawings):

A. Plastic Slats

1. Manufacturer:
Patrician Products
100 Frank Road
Hicksville, NY 11801
(516) 937-3580

2. Product: Plastic Vertical Tubing: PVT

a. Provide “Vandal Proof” locking strip.

3. EXECUTION:

3.1 INSTALLATION:

A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

3.2 EXCAVATION: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

3.3 SETTING POSTS: Center and align posts in holes 3” above bottom of excavation.

A. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

Unless otherwise indicated, extend concrete footings 2” above grade and trowel to a crown to shed water.

3.4 TOP RAILS: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

3.5 BRACE ASSEMBLIES: Install braces so posts are plumb when diagonal rod is under proper tension.

3.6 FABRIC: Leave approximately 2” between finish grade and bottom salvage,unless otherwise indicated. Pull fabricate taunt and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

3.7 STRETCHER BARS: Thread through or clamp to fabric 4” o.c., and secure to posts with metal bands spaced 15” o.c.

3.8 GATES: Install gates plumb, level, and secure to full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.9 TIE WIRES: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.

Tie fabric to line posts, with wire ties spaced 12” o.c. Tie fabric to rails and braces,with wire ties spaced 24” o.c. Tie fabric to tension wires, with hog rings spaced 24” o.c.

3.10 Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.11 Inserts (where called for on approved drawings): Install per manufacturer’s instructions. Pop rivet locking strips at ends.

## END OF SECTION 32 31 13

# SECTION 32 31 19 – ORNAMENTAL METAL FENCING AND GATES

1. GENERAL:

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. DESCRIPTION: Provide Ornamental Metal Fencing, complete, as shown and specified per Contract Documents.

B. RELATED WORK SPECIFIED ELSEWHERE:

1. Section 03 30 00 – Concrete Work
2. Section 08 71 00 – Finish Hardware
3. Section 32 31 13 – Chain Link Fencing

1.3 QUALITY ASSURANCE:

A. Provide ornamental metal fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

B. Reference Standards: All welding shall be per AWS D1.1 Structural Welding Code.

C. Qualifications: All welders employed for work hereunder shall hold current AWS certification.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data, and installation instructions for ornamental metal fencing, gates, and accessories.

B. Shop Drawings: Submit shop drawings indicating extent, type, gate locations, and post footing details.

1.5 GUARANTEE:

A. Submit upon completion of the work, in the form prescribed under Section 01 77 00 – Contract Closeout, covering all materials and workmanship under this Section for a period of one (1) year and five (5) years against rust from the date of final acceptance by the Owner.

2. PRODUCTS:

2.1 MATERIALS:

A. ORNAMENTAL METAL FENCE:

1. General: Fences and gates shall be the Modified Heavy Regal fence system with double top rail with one row of rings and picket stubs. Fence system to be welded construction and manufactured by Builders Fence Company, Inc., or approved equal.
2. Architectural and Miscellaneous Steel: ASTM A36.
3. Hot Rolled Structural Steel: ASTM A513 or A500.

B. GATE HARDWARE:

1. Lock Box: See plan for size, must be able to accommodate Panic Hardware
2. Hinges: Barrel type ball bearing; No. 833353 manufactured by the Builders Fence Company, Inc., or approved equal, for exterior use.
3. Drop Rod; Lockable: No P491133; ¾ inch diameter rod; padlock eyes included; manufactured by the Builders Fence Company, Inc., or approved equal. Provide bolt sleeve for insertion into concrete.
4. Gate: Must be able to be locked in the open position at 180 degrees from closed position.
5. Panic Device (where called for): Corbin Russwin ED8200 (Nightlatch function) w/ P857 Wing Pull. Provide Schlage Primus Keyways per Section 08 71 00 – Finish Hardware. Manual cane bolts are prohibited on leaf with panic device.
6. Kickplate: Provide 10” high galvanized steel kickplate on both sides of gate.
7. Miscellaneous Hardware: Items of hardware such as padlock eyes, etc., shall be fabricated by the fence manufacturer.
8. The post on each side of a pedestrian gate must be braced together by a welded header of the same material as the posts (see approved drawings) at a minimum of 7’-0” above walking surface.
9. Expanded Metal Mesh (Vandal Screens): ASTM F 1267, Type II (expanded and flattened), Class 2 (G90): ¾” x #11 with ¾” x 1/8” steel flat bar welded around the perimeter. Mesh shall be attached around the sides of the gates as shown on the approved drawings to prevent the ability to reach around the sides to open the gates.

C. HORIZONTAL SLIDE GATES

1. Gate Configuration: Single Leaf
2. Gate Frame Height: See Approved Plans
3. Gate Opening Width: See Approved Plans
4. Steel Frames and Bracing: Fabricate members from square tubing. Hot-dip galvanize frames after fabrication.

    a. Frame Members: Square tubes 2 by 2 inches with 1/8-inch wall thickness.
    b. Bracing Members: Steel tubing 2 by 2 inches with 1/8-inch wall thickness.

5. Additional Rails: Provide as indicated, complying with requirements for fence rails.
6. Infill: Comply with requirements for site fencing.
7. Picket Size, Configuration, and Spacing: Comply with requirements for site fencing.
8. Overhead Track Assembly: Manufacturer’s standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design and roller assemblies.
9. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

D. FASTENINGS:

1. General: Furnish bolts, nuts, screws, washers, and other various fastenings necessary for proper erection of work. Welding: Per AWS Standards where applicable.
2. Exposed in Finished Surfaces: Countersunk Phillips flat head screws, unless otherwise shown, finish matching adjacent surfaces.
3. Expansion Bolts: FS FF-S-325, Group III expansion shield (self-drilling tubular expansion shield bolt anchor) Type 1 or 2, unless otherwise shown.

E. GALVANIZING:

1. General: Hot-dip process per ASTM A123, A153, or A385, as Applicable Minimum coating: 2 oz. per square foot.
2. Repair Treatment: Galvaloy or approved equal.

F. PRIMER: Manufacturer's standard high solids polyurethane primer.

G. PAINT: Manufacturer's standard gloss polyurethane paint. **Color**: **As Selected by District.**

H. FINISH: Galva-Guard II or equal: Factory finish after galvanizing with one spray coat of high solids polyurethane primer and one spray coat of gloss polyurethane paint.

2.2 FABRICATION:

A. GENERAL: Shop assemble work in largest practicable sections to minimize field connections. File or grind smooth parts exposed to finish view; remove weld marks and leave free of noticeable marks. Bends, twists, open joints in finished members or projecting edges or corners at connections will not be permitted. Provide bolts and fastenings necessary to complete fabrication.

B. ASSEMBLY:

1. General: Provide as shown; pickets shall be welded to rails top and bottom. See drawing for typical welding location.
2. Welding: Per AWS Standards. Grind all welds smooth on exposed surfaces. Spot welding not permitted on exposed surfaces.
3. Swing Gates: Fully welded one-piece frame, pickets welded to horizontal frame members top, bottom and sides. Install top hinge reverse to prevent unauthorized removal of gate. See drawing for typical welding locations.
4. Sliding Gates: Fully welded one piece frame, pickets welded to horizontal frame members top, bottom and sides.
5. Reinforcement: Provide proper reinforcement for hardware and where required on metal work. See gate plan for reinforcement location.
6. Hardware: Install as recommended by manufacturer as shown.

C. MATERIALS:

1. End post and line post shall be 3" x 3" x 3/16", Tubular Steel. Install decorative 2" ball (typical) on lie and end post.
2. Gate/Hinge Post: Shall be 4" x 4" x 3/16" Tubular Steel.
3. Horizontal: Bottom Rail shall be 2" x 2" x .095" Tubular Steel. 1/8 inch fillet weld all around at post connection.
4. Horizontal: Middle rail and top rail shall be 1" x 2" x 1/8" channel. 1/8 inch fillet weld all around at post connection.
5. Horizontal (Sliding Gate): Bottom Rail shall be 4" x 2" x .095" channel.
6. Vertical Tubing (Pickets & Picket Stubs): Shall be 1" x 1" x .095 Tubular Steel, weld vertical tubing to horizontal rails with 1/8 inch fillet weld all around.
7. Rings: Shall be 1/2" thick x 1" wide full circles. Weld to top and middle rails.

D. CLEANING: After fabrication panels, gates and posts shall be power washed in a phosphoric acid solution, rinsed and dried.

E. GALVANIZING: All galvanizing shall be performed after fabrication in the largest practical sections. All areas burned off or damaged during fabrication or erection shall be treated with specified protective compound.

F. FINISH: Galva-Guard II or equal: Factory finish after galvanizing with one spray coat of high solids polyurethane primer and one spray coat of gloss polyurethane paint.

3. EXECUTION:

3.1 EXAMINATION OF CONDITIONS:

A. SUBSTRATE CONDITIONS: Examine substrate. Report major defects to owner. Starting of work is acceptance of conditions as they exist.

B. JOB MEASUREMENTS: The Contractor shall take field measurements for this work and be responsible for it. Report any major discrepancy between plan and field dimension to the Owner.

3.2 INSTALLATION:

A. GENERAL: Install in strict conformance with referenced standards, manufacturer's written directions, as submitted to and reviewed by Architect during the submittal process, as shown and as specified.

B. COORDINATION: Deliver items to be set in concrete or masonry, complete with the clips, anchors or bolts necessary to secure them in place.

C. Install gates level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operations and lubricate where necessary.

D. WORKMANSHIP: Set work plumb and true; properly assemble and erect in a rigid and workmanlike manner. Replace, or repair parts damaged during erection in an acceptable manner.

E. GALVANIZING: All areas damaged during erection shall be treated with specified protective compound.

F. FIELD TOUCH-UP: Touch-up damaged surfaces as recommended by the paint manufacturer and Owner.

G. PROTECTION: After erection, provide proper protection from other construction operations.

3.3 ADJUSTMENTS AND MAINTENANCE:

A. Prior to acceptance of project, all moveable parts shall be properly adjusted to assure smooth operation.

3.4 CLEANING:

A. Upon completion, thoroughly clean all exposed surfaces in a manner that will not affect the finish appearance.

**END OF SECTION 32 31 19**

# SECTION 32 84 00 – IRRIGATION SYSTEMS

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. DESCRIPTION: Irrigation system complete including (but not limited to) the following principal items:

1. Trenching and stockpiling excavation materials. Refilling trenches and sowing of grass seed.
2. Furnishing materials and installations for complete system including pre-wired controller enclosures, booster pumps, piping, valves, fittings, sprinkler heads, and final adjustment of heads to insure complete coverage.
3. Electrical lines and line-voltage connections to the irrigation controllers and booster pumps, phone connection to pedestal and low voltage control wiring from controllers to remote control valves.
4. Sleeving.
5. Replacement of unsatisfactory materials.
6. Clean-up.
7. Tests.
8. Record Drawings.

1.3 QUALITY ASSURANCE

A. QUALIFICATIONS: Provide at least one person who shall be present at all times during execution of this portion of the work who shall be thoroughly familiar with the type of equipment and type of materials being installed and the equipment and materials manufacturer's recommended methods of installation and who shall direct all work performed under this Section.

B. CERTIFIED INSTALLER: Maxicom equipment (controllers enclosure, flow sensor master valves, communication wire) shall be by a certified Maxicom Installer as per the Rain Bird Maxicom Certification Program. Contractor must show evidence of such proof with submittals.

C. APPLICABLE CODES: All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code, and other applicable State or local laws or regulations. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes.

1. When the Specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the Specifications shall take precedence over the requirements of the said rules and regulations.

2. The Contractor shall furnish without any extra charge any additional material and labor when required by the compliance with these rules and regulations, though the work not be mentioned in these particular Specifications or shown on the Drawings.

3. Protection of persons and property shall be provided throughout the progress of the work. The work shall proceed in such a manner as to minimize the spread of dirt, dust, mud and flying particles and to provide safe working conditions for personnel, users of the site and adjacent property Districts. The Contractor shall erect and maintain barricades, temporary fencing, guards, warning signs, and lights as necessary or required by OSHA. No unprotected open trenches are permitted overnight.

4. Any existing building, equipment, piping, cover and boxes, utilities, sidewalks, landscaping, etc., damaged by the Contractor during the course of his work shall be replaced or repaired by the Contractor in a manner satisfactory to the District or his representative, and at the Contractor's own expense, and before the final payment is made. The Contractor shall be responsible for damage caused by leaks in the piping systems being installed by him. He shall repair, at his own expense and to the District's satisfaction, any and all damage so in a manner satisfactory to the District or his representative.

5. Electrical work to be performed by licensed Electrical Contractor. See Section 26 00 00.

1.4 SUBMITTALS

A. Prior to starting any work, the Contractor shall present to the District's Representative the following information:

1. Project name and location
2. Name of Contractor's representative on job and his title
3. Construction Schedule.
4. Four copies of a list of all irrigation system materials proposed to be furnished and installed for approval before any materials are delivered to the job site. Show manufacturer's name and catalogue number for each item, furnish complete catalogue cuts and technical data, and furnish the manufacturer's recommendations as to method of installation.
5. Maxicom Certification.

B. Upon approval of the Landscape Architect, the manufacturers' recommendations shall become the basis for acceptance or rejection of actual methods of installation used in the work.

1.5 RECORD DRAWINGS

A. On a reproducible copy of the Irrigation Plan (i.e., xerox on vellum) supplied by the District’s Representative the Contractor shall daily record any changes to the Plans in order to create an As Built record set. Underground installations shall be indicated with at least two measurements from surface features such as walks, buildings or sprinkler heads. Show locations of controllers, communication cable, mainline pipe, reduced pressure vacuum breaker, gate valves, remote control valves, quick coupler valves, pull box locations, splice locations, caps and tie ins. Record all utilities encountered in the field.

B. Keep record prints and transcribe to an electronic file (.dwg) provided by the District. Cloud all changes and submit to District’s Representative before final payment shall be made for work installed.

C. Supply to District's Representative an electronic file (in Microsoft Excel) and hard copy of a complete and final valve index including a listing of final valve numbers, sprinkler type, plant type: shrub or lawn, precipitation rate and GPM based on field changes.

D. Supply to District's Representative an electronic file (in Microsoft Excel) and hard copy of a complete Water Audit of any existing sprinklers to be retained which should include valve locations, sprinkler type and locations, plant type: shrub or lawn, nozzle size, precipitation rate, and GPM for the entire circuit.

E. Supply to the District's Representative a list of all Rain Bird products including quantities installed on the job and copies of all receipts.

1.6 OPERATION AND MAINTENANCE DATA

A. Upon completion, provide two sets of manufacturer's warrantees, guarantees, instruction sheets, parts lists and operational manuals to the District's Representative. The final walk-through will not be made until the sets are approved by the Landscape Architect.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect irrigation system materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the District.

1.8 REMOVAL OF EXISTING IRRIGATION SYSTEM BEING DISMANTLED

A. For renovation projects, if required by school district, remove existing equipment as indicated on the plans or as directed in the field and deliver to SUSD corporation yard.

B. Replacements; In the event of damage, immediately make all repairs and replacements at no additional cost to the district.

2. PRODUCTS

2.1 MATERIALS

A. The materials will be as specified. All materials shall be new. Any deviation from the specifications must first be approved by the Landscape Architect in duplicate. All materials shall be clearly marked by manufacturer on all material containers or certificates of contents for inspection.

B. The Contractor must furnish and install the materials, product or equipment items specified unless the substitution of an equal material, product or equipment item is approved by the Landscape Architect prior to installation. Any credit earned by the substitution must be refunded to the School District.

2.2 PIPE

A. Main lines (constant pressure) 2-1/2" and larger shall be polyvinyl-chloride (PVC) 1120, Class 200 with ring-tite fittings. Main lines 2" and smaller shall be PVC Schedule 40 pipe with Type 1, Grade 1 PVC Schedule 40 solvent weld fittings.

B. Lateral line (non-pressure) 2-1/2" and larger shall be polyvinyl-chloride (PVC), Schedule 40 with Schedule 40 solvent weld. Lateral lines 2" and smaller shall be PVC Schedule 40 pipe with Type 1, Grade 1 PVC Schedule 40 solvent weld fittings.

C. Sleeves: All PVC sleeves under pavements and roadways shall be Schedule 40 or Class 315 (2" and larger). Sleeves must be twice the diameter of pipe or wire bundle that will pass through the sleeve. All ring-tite pipe that would pass through sleeves shall be changed to Class 315 solvent weld pipe of the same size. Install a 4" layer of sand under pipe in trench.

D. All markings shall face up.

E. Solvent and primer for solvent weld joints shall be of make and type approved by manufacturer(s) of pipe and fittings and shall conform to ASTM D-2564. These products shall be maintained at proper consistency throughout use. PVC Primer to be Weld-On 70 or approved equal.

F. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Teflon Tape must be utilized on all plastic to plastic threaded connections including swing joints.

2.3 RISERS

A. Sch 80 PVC as shown in the irrigation details.

B. Sch 80 PVC for valves and quick couplers per details.

C. Pop-up sprinklers: 3-way swing joints with marlex fittings.

D. Rotors: 3-way swing joints with marlex fittings.

2.4 CONTROLLERS AND ENCLOSURES

A. Controllers and enclosures shall be UL listed and type indicated on the Drawings.

B. Provide and install automatic irrigation controller enclosures at approximate locations shown on Drawings. The exact location will be determined on the site by the Landscape Architect and School District representative.

C. Provide only pre-wired enclosures as specified on the Drawings and assembled complete with all satellites, CCUs, decoders, transmitters, surge protection, terminal strips and miscellaneous hardware pre-installed. .

D. Provide reinforced 6" concrete pad with necessary sweeps within the footprint of the enclosure. Concrete mix to be 5 sack and reinforcing to be 6x6 10x10 welded wire mesh. See District Standard Detail.

E. Install enclosure per manufacturer's direction. All power sources and communication wires to be brought into enclosure through the sweeps with no exterior connections. Include a 1" PVC conduit for phoneline to the CCU.

F. All electric components shall be properly grounded according to Maxicom Grounding Specifications. See District Standard Detail.

G. Maxicom Representative to inspect installation prior to power-up.

2.5 REMOTE CONTROL WIRE

A. Control wire shall be solid copper 600 volt AC, type UF-AWG, UL-approved for direct burial in ground and continuously marked with manufacturer's name, wire size and identification.

B. Color:
1. Lead wires: No.14, color other than white
2. Common wire: No.12, white
3. Spare wire: No. 14, black

C. Spare wire: One looped continuous extra lead wire must be provided from each controller to its respective valves.

D. Confirm need for extra remote control valve wire with District's Representative.

2.6 VALVE BOXES

A. Boxes for remote control valves to be Carson-Brooks Box 1419 or 1220 with bolt down T-cover with penta-head bolt or accepted equal. Box body shall have knock-outs. Color: green. Size boxes to accommodate both remote control valves and ball valves in single box.

B. Boxes for quick-coupler and gate valves to be Carson-Brooks Box 910 with bolt-down lid and penta-head bolt.

C. Where applicable, valve boxes shall be placed in a neat, orderly fashion, no closer than 12" apart. Round valve boxes, 10" diameter, to be used for quick coupler or gate valves only. See District Standard Detail.

2.7 SPRINKLER HEADS

**A.** Sprinkler heads shall be as listed below or accepted equal. Install PRS screens as noted on the Drawings or as required to eliminate overspray.

1. Rain Bird Pop-Up Spray Heads 1800 Series.

2. Rain bird 5000

3. Rain Bird Falcon Rotor.

2.8 VALVES

A. Remote Control Valves: PEB Series by RAIN BIRD or accepted equal. See Valve Index for sizing. Provide PRS-B (pressure regulating module) for low pressure circuits.

B. Master Valves: see Flow Sensing Zone below.

C. Ball Valves: Bronze threaded ball valves by Nibco or accepted equal. No PVC Ball valves are acceptable as equal.

D. Gate Valves: Class 125 flanged iron body gate valves by Nibco or accepted equal.

E. QC Valves: 44LRC, 44K valve key and 2049 cover key with 1" male threads and swivel hose ell SH-1 all by RAIN BIRD or accepted equal. Provide brass ball valve at each QC valve.

F. Manual Valves: Champion 100-xxx series RS straight valves in combination with Champion 362-xxx atmospheric vacuum breakers.

G. Air Release Valves: APCO 200A.

H. Identify each valve's satellite station number with Plastic waterproof tag.

2. 9 BACKFLOW PREVENTER

A. Reduced pressure backflow prevention assembly by Wilkens or accepted equal. Wilkens #975XL for sizes ¼" through 2" and Wilkens #375 for sizes 2 ½" through 8".

B. Provide and install lockable expanded metal enclosure for RPBP assemblies that are smaller than 6". Enclosure to be Cross Brothers BPSE 3-4P or accepted equal installed on a concrete slab. Provide case hardened chain and padlock to secure RPBP assemblies that are larger than 4".

C. Provide reinforced 6" concrete pad at RPBP assembly with or without enclosure. Concrete mix to be 5 sack and reinforcing to be 6x6 10x10 welded wire mesh.

D. Provide and install an insulated backflow blanket as manufactured by REPCOR (tel: 510-489-2233) or equal.

2.10 FLOW SENSING ZONE

A. Provide and install the Maxicom Flow Sensing Zone Installation Package. See Model number and components on Drawings.

B. Install flow sensors and master valves in Carson Brooks valve box with a T cover and penta-bolt, or approved equal.

2.11 BOOSTER PUMP

A. Watertronics Booster Pump Assembly or equal activated automatically upon a flow to the irrigation piping system. The assembly to include a variable frequency drive, an internal bypass and an enclosure supplied with internally mounted heavy duty latch which locks to keep the access door open and a continuous stainless steel hinge with drip shield. Enclosure to be mounted on a concrete pad with opening for suction and discharge line entering and exiting the enclosure.

B. Features to include:

1. 14 ga. steel enclosure
2. UL listed control panel
3. Lockable access cover
4. External electrical disconnect
5. Internal magnetic starter and controller
6. Pressure reducing valve
7. Liquid filled pressure gauge on discharge manifold
8. Lightning and surge protection for controls
9. Low flow switch
10. Pump operation indicator lights.
11. Internal bypass line
12. Enclosed ventilation fan

13. Low pressure alarm with safety shut down
14. High temperature alarm with safety shut down
15. Hand/off/auto selector switch
16. Main station isolation, check and drain valves
17. Two part polyurethane ultraviolet insensitive paint
18. Factory tested at full design flow and pressure
19. 12 month limited warranty
20. Technical start-up by Watertronics trained technician

C. Concrete pad to be 6" thick with 6x6 10x10 welded wire mesh reinforcing held 2" from the bottom of the pour. Concrete mix to be 5 sack. Anchor booster station to pad with 1/2" wedge anchors secured in 1/2" diameter holes drilled into slab with masonry bits.

2.12 COMMUNICATION WIRE

A. Communication wire between flow sensors and pulse transmitters and between Satellite Controller and CCU to be PE-39 wire in grey Sch. 40 conduit at least 1-1/2" in diameter. DO NOT SPLICE. Provide pull boxes 250 feet on center maximum with a 36" loop in each pull box. Show pull box locations on AS-BUILTS.

2.13 SPLICE PACKS

A. Model no. DBY and DBR (for multiple splice wires) manufactured by 3M Company or accepted equal for remote control valve wires.

B. SERVISEAL Closures for communication wire and flow sensor. Splice all pairs.

2.14 MISCELLANEOUS INSTALLATION MATERIALS

A. Provide any and all additional equipment called for by the Drawings or as necessary for a complete and proper irrigation system installation. Install additional sprinkler heads as necessary to provide complete coverage by the irrigation system without additional charge to the District.

B. Provide to the District, at completion of the Maintenance Period, one (1) each: sprinkler bodies, nozzles and risers used in construction of the system for use as replacement parts, and all operating and servicing keys, screwdrivers and wrenches required for complete maintenance and operation of all heads and valves. Include tools necessary for complete disassembly of all heads and valves.

C. All other materials, not specifically described but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and subject to the approval of the Landscape Architect.

3. PRODUCTS

3.1 SURFACE CONDITIONS

A. EXISTING SITE CONDITIONS

1. Locations of existing utilities and other improvements shown on the Construction Documents are approximate. For renovation projects existing conditions shall be verified. Contractor shall hire an underground surveying company to locate underground utilities prior to any trenching. Contractor shall be responsible for all repairs to any damaged underground utilities. Should any utilities be encountered, their position must be recorded on the Record Drawings and any repair required must be completed by the Contractor. The Contractor shall be held responsible for any damages caused to existing services.

2. Contractor shall verify the location of all underground utilities prior to trenching operations. Contact USA (i.e., Underground Service Alert) at (800) 227-2600 at least 48 hours prior to start of excavation and trenching.

B. INSPECTION:

1. Verify that the irrigation system is installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturers' recommendations.

C. DISCREPANCIES:

1. In the event of discrepancy, immediately notify the Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FIELD MEASUREMENTS

A. Make all necessary measurements in the field to ensure precise fit of items and complete coverage in accordance with the original design.

3.3 TRENCHING AND BACKFILLING

A. Perform all trenching and backfilling necessary for this portion of the Work, strictly conforming to the requirements for trenching and backfilling described in these Specifications. See Section 3.5 D and K.

3.4 BORE AND JACK

A. The Contractor is responsible for all undercrossings of conduit and piping. The existing concrete walkways shall not be cut. The Contractor shall dig a sending and receiving pit on either side of the walkway and "drill/bomb" under the concrete walkways. These water/air processes shall permit the installation of all required sleeves under concrete. The Contractor is then responsible for backfill and compaction per the Specifications.

3.5 INSTALLATION OF PIPING

A. PREPARATION: Schedule and coordinate placement of materials and equipment in a manner to effect the earliest completion of work in conformance with construction and progress schedule.

B. HANDLING, STORAGE AND ASSEMBLY:

1. The Contractor is cautioned to exercise care in handling, loading, unloading, and storing PVC pipe. Beds on which materials are stored must be full length of pipe to avoid damage. PVC pipe and fittings shall be especially protected from direct sunlight. Any section of pipe that has been dented or damaged shall not be used in the work.

2. Handling, assembly of pipe, fittings and accessories shall be accomplished by skilled tradesmen. Interior of pipes, fittings and accessories shall be kept clean at all times. Close ends of pipe immediately after installation and leave closure in place until removal is necessary for completion of installation.
3. Bending is not permitted.

C. LAYOUT:

1. Provide pipe sleeves of appropriate size and location.

2. Layout work as accurately as possible in accordance with diagrammatic drawings.

3. Locate laterals and mainline at least 18” away from curbs, edge of sidewalks and building walls. See District Standard Detail.

4. Review site conditions during layout to avoid trenching close to existing tree locations.

5. Where site conditions do not permit locating piping, valves and heads where shown, notify Landscape Architect immediately and determine relocation in joint conference. Run pipe lines and automatic control wiring in common trenches wherever practical.

6. The drawings are generally diagrammatic to the extent that swing joints, offsets and all fittings are not shown. The Contractor shall be responsible for full and complete coverage of all irrigated areas and shall make any necessary adjustments at no additional cost to the District. If discrepancies are found, the Contractor shall notify the District's Representative before proceeding.

7. See District Standard Detail for required minimum for horizontal and vertical separation of pipe.

8. Piping installed in the same trench shall be installed side by side and not over each other.

D. EXCAVATING AND TRENCHING:

1. All trenches shall be open vertical construction, sufficiently wide to provide ample working space and depths as specified. PVC pipe may be made up on the surface, then laid in the trench.

2. Make trenches for pipe lines deep enough to provide minimum cover from finish grade as follows:

   a. 24" minimum cover over pipe lines located under vehicular paving areas;
   b. 18" minimum cover over main lines to control valves and quick coupling valves;
   c. 18" minimum cover over control wires from controller to valves;

d. 12" minimum cover over RCV-controlled lines to sprinkler head.

3. Contractor shall be responsible for installing all irrigation features to their finished grade and at depths indicated. All rough grading and or finish grading shall be completed and/or accommodated before trenching commences.

4. Restore surfaces, existing underground installations, etc., damaged or cut as result of excavations, to original condition in manner approved by Landscape Architect.

5. All underground utilities to be located by Contractor prior to excavation. Where other utilities interfere with irrigation, trenching and pipe work; adjust the trench depth as necessary. Note locations of all utilities encountered on As-Builts.

E. ASSEMBLING PIPE LINES:

1. All pipe shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed. Pipe shall not be bent to accomplish a joint.

2. Rubber Ring Seal Joint:

a. Use factory -made male end or prepare field-cut male end to exact specifications of factory-made end.
b. Carefully clean bell or coupling and insert rubber ring without lubricant. Position ring carefully according to the manufacturer's instructions.
c. Lubricate male end according to manufacturer's instructions and insert male end to specified depth. Use hands only when inserting PVC pipe.
d. Thrust blocks shall be provided when ever and where ever necessary to resist system pressure on ring-tite pipe, and any and all fittings, couplings, valves, etc. during testing when the trenches are open as well as during the normal operation of the system. The positioning of these blocks is not shown on the plans and is the responsibility of the Contractor to locate and install. Blocks shall be concrete and the size shall be based on an average soil safe bearing load of 1000 pounds per square foot.
e. Form thrust blocks in such a manner that concrete comes in contact only with the fittings. Thrust blocks shall be between solid soil and the fitting.

3. Solvent weld joint:

a. Prepare joint by first making sure the pipe end is square, then deburring the pipe end and cleaning pipe and fitting of dirt, dust and moisture prior to applying solvent.

b. Dry insert pipe into fitting to check for missizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.
c. Coat the inside socket surface of the fitting and the external surface of the male endof the pipe with the P-70 primer (manufactured by Weld-On). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
d. Insert pipe immediately into fitting and turn ¼ turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.

e. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
f. Cure joint a minimum of thirty (30) seconds before handling and at least six (6) hours before allowing water in the pipe.

4. Threaded joint:

a. Field-threading of plastic pipe or fitting is not permitted.
b. Factory-made nipples shall be used wherever possible. Field-cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading galvanized pipe, cut threads accurately on axis with sharp dies.
c. On PVC to metal connections, the Contractor shall work the metal connection first. A non-hardening pipe dope (Permatex No. 2 or approved equal) shall be used on all threaded PVC to metal joints and light wrench pressure is all that should be required.
d. Where threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded. Utilize Teflon tape on threaded PVC connections.

5. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstruction. Remove caps or plugs only when necessary to continue assembly.

6. Where pipe or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

7. Trenches shall be padded with sand if the soil is extremely rocky.

8. PVC pipe should never be laid when there is water in the trench or when the temperature is 32 degrees F or below.

9. Snake pipe from side to side of trench bottom to allow expansion and contraction.

10. The Contractor is responsible for the installation of necessary sleeves and conduits of sufficient size under all paved areas where required.

F. REMOTE CONTROL VALVES:

1. All RCV's to be located at grade in specified valve boxes and placed one per valve box.

2. Layout of valve piping shall provide ample clearance between the edge of the box, the ground and other valves to allow for easy removal of any valve.

3. Base of valve box to be filled with gravel to a 3-inch depth. See RCV detail.

4. Locate valves no closer than 12 inches from walk edges and building walls.

5. Provide continuous support at base of valve box with 6” x 24” bricks. See District Standard Detail.

6. Thoroughly flush main line before installing valves.

7. All valves shall have a union installed at each side of valve.

G. AUTOMATIC CONTROL WIRING:

1. Run wire beside main lines wherever possible. Tie wires in bundles with zip ties at 10 foot intervals and allow slack for contraction between strappings.

2. Loop a minimum of two (2) feet of extra wire into a 1-1/2 -inch diameter coils at all valve connections (both control wire and ground wire).

3. Connections shall be made by crimping bare wires with brass connectors and sealing with epoxy resin sealer packs.

4. Splicing will be permitted only on runs exceeding 2500 feet. Locate all splices at valve locations or in valve boxes.

5. Where control lines pass under paving or are not laid under main line, they shall pass through Schedule 40 electrical PVC conduit.

6. Provide continuous spare wire for each controller. Identify with permanent label at each location.

H. AUTOMATIC CONTROLLER AND ENCLOSURE:

1. Connect control wires to controller in sequential arrangement according to assigned identification number of valve. Control lines shall be labeled at controller with permanent non-fading labels indicating identification number of valve controlled.

2. See Plan and Details for location of the controller and CCU. Confirm location with District and/or District's Representative. Perform final wiring per manufacturer's recommendations. Maxicom Representative to review and certify the installation prior to power up.

I. THRUST BLOCKS:

1. Provide thrust blocks at all changes in size or direction of pipe. Bends, reducers, plugs and the opposite side of Tee branches require thrust blocks. Size of thrust blocks is determined by the working pressure, size and type of fitting and the soil conditions present at the jobsite. To calculate area of concrete thrust block in contact with soil first calculate total thrust by size and type of fitting from Table 1 and multiply thrust/100 by system pressure divided by 100. Divide total thrust by bearing capacity of soil in excavation (from Table 2) to determine area (in square feet) of thrust block required to be in contact with the undisturbed soil. For reducers, subtract small opening plug thrust from large opening plug thrust to calculate thrust/100.

2. The thrust block should be constructed of concrete having a compressive strength of 2000 psi or more. The size of the thrust block should be adequate to prevent pipe movement at the point of thrust.

3. The thrust block should be hand dug in undistrubed soil and framed with soil or wood to hold freshly poured concrete. The earth-bearing surfaces should be undisturbed. Before pressurizing the line, ensure that adequate time is allowed for the concrete blocks to set.

TABLE 1 - THRUST/100 TABLE (Pounds per 100 psi)

| Size | Tees, Plugs | 90 | 45 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 2" | 363 | 513 | 259 |
| 2.5" | 531 | 751 | 379 |
| 3" | 788 | 1,114 | 562 |
| 3.5" | 1,302 | 1,841 | 928 |
| 4" | 2,822 | 3,990 | 2,012 |

TABLE 2- SOIL BEARING CAPACITY

| Soil Type | Safe Bearing Load (lbs. per sf) |
|---|---|
| Soft clay | 1,000 |
| Sand | 2,000 |
| Sand and gravel | 3,000 |
| Sand and gravel cemented with clay | 4,000 |
| Hard Pan | 5,000 |

J. TESTING:

1. Perform test as specified. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.

K. BACKFILLING:

1. All work must be inspected and approved prior to covering. Notify District's Representative 48 hours prior to filling trenches.

2. Backfill material shall be the earth excavated from the trenches, free from rocks, concrete chunks, and other foreign or coarse materials. Carefully select backfill that is to be placed next to plastic pipe to avoid any sharp objects which may damage the pipe.

3. All pipe under asphalt paving shall be backfilled with 4 inches of clean sand on all sides of pipe. Pipe shall have a uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking of pipe will not be permitted.

4. Place backfill materials in 6-inch layers and compact mechanically to a minimum compaction of 90 percent of original soil density.

5. Dress off all areas to finish grades and remove excess soil, rocks or debris remaining after backfill is completed.

6. If settlement occurs along trenches, and adjustments in pipes, valves and sprinkler heads, soil, sod or paving are necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, the Contractor, as part of the work under this Contract, shall make all adjustments without extra cost to the District.

L. SPRINKLER HEADS AND QUICK COUPLER VALVES:

1. Thoroughly flush lines before installing heads and quick coupler valves. Operate system at full pressure until all rust, scale and sand is removed. Divert water to prevent ponding or damage to finished work.

2. Locate heads and quick coupler valves as shown in the Drawings and details.

3. Locate heads 6" from walks or backs of curbs.

4. Adjust sprinkler heads for proper distribution and trim.

5. Install lawn heads at finish grade in lawn areas.

6. If the irrigation plan does not allow for the proper distribution of water to all plant material, make appropriate field changes of sprinkler nozzle type or sprinkler body location. Add additional sprinkler bodies where required.

7. Locate as shown on construction drawings, except where existing conditions prohibit. Sprinkler head spacing shall not exceed the maximum shown on the construction drawings. Coverage shall be as good or better than shown on the construction drawings.

8. Install Quick Coupler line after Backflow preventer device and before Pump.

9. Install Ball Valve before each Quick Coupler Valve within separate valve box.

10. Quick Coupler to be installed with all galvanized iron fittings.

M. AIR RELEASE VALVES: Provide as shown on drawings or as necessary to eliminate surges.

3.6 TESTING AND INSPECTION

A. VISUAL INSPECTION: Pipe shall be homogenous throughout and free from visual cracks, holes or foreign materials. Inspection shall be made by Contractor on each length of pipe. All materials are subject to impact test at the discretion of the District's Representative.

B. HYDROSTATIC TESTING - MAINLINE:

1. Request the presence of the Landscape Architect in writing at least 48 hours in advance of testing.

2. Testing to be accomplished at the expense of the Contractor and in the presence of the Landscape Architect and/or District’s Representative who will confirm pressure reading at start and completion of test.

3. Center load piping with backfill to prevent arching or slipping under pressure. No fittings shall be covered.

4. Apply the following test after weld plastic pipe joints have cured at least 24 hours and the risers have been capped:

5. Test live (constant pressure) and QCV lines hydrostatically at 125 psi minimum. Main lines and sub-mains will be approved if test pressure is maintained for six (6) hours. The Contractor shall make tests and repairs as necessary until conditions are met.

6. Test RCV-controlled lines with water at working pressure with remote control valves in place and swing joints capped and visually inspect for leaks. Retest after correcting defects.

7. Test to determine that all sprinkler heads function according to manufacturer's data and give head to head coverage according to intent of Construction Documents. Replace any sprinklers not functioning as specified with ones that do or otherwise correct system to provide satisfactory performance.

8. The Contractor shall make adjustments in head locations and adjust heads for radius and arc to provide optimum coverage and to minimize spraying onto cars, pavement (where overspray is not intended), building or adjacent areas at no expense to the District.

E. INSPECTION:

1. The Contractor shall be subject to inspections at any and all times by the authorized representative of the Landscape Architect and the District.

3.7 GUARANTEE

A. It shall be the responsibility of irrigation Contractor to fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for 12 months following completion and acceptance of job. See turf planting section of the Specifications.

B. The Contractor shall also guarantee all materials, equipment and workmanship furnished by him to be free of all defects of workmanship and materials and shall agree to replace at his expense, at any time within one year after installation is accepted, any and all defective parts that may be found. If any materials or hardware are replaced during that period, the guarantee shall be extended for the material or hardware for an additional 12 month period.

3.8 INSTRUCTIONS

A. Remote control legend and Irrigation Plan: attach a laminated, typewritten legend and laminated reduced (11” x 17”) Irrigation Plan inside each controller door stating the areas covered by each remote control valve. Circuits on Plan to be identified by color. Valves, or adjacent piping in the valve box, are to be labeled with an indelible marker with the appropriate number corresponding to the controller legend for easy identification of valves. These reduced plans and legends are required for new and existing controllers.

B. Maintenance personnel: After the system has been completed, inspected and approved, instruct the District's maintenance personnel in the operation and maintenance of the irrigation system and demonstrate the contents of the manual furnished.

3.9 CLEANING

A. Contractor shall maintain cleanliness in all areas of his operation, and will be held responsible for immediate removal of all debris in these areas. Keep premises free from accumulation of waste and rubbish. Daily, and at the completion of work, remove surplus materials, rubbish and debris. The site must be maintained in a clean and safe condition.

3.10 MAINTENANCE PERIOD

A. Irrigation Maintenance Period shall not commence prior to Maxicom system being fully operational with all data loaded and running. Irrigation Maintenance Period is sixty (60) days after formal acceptance by the District and District’s Representative.

3.11 FINAL WALK THROUGH

A. Request the presence of the Architect 48 hours prior to the final walk through.

B. At this time the system will be demonstrated by the Contractor and a punch list will be prepared by the Architect indicating the final items that must be completed prior to formal acceptance by the District.

## END OF SECTION

# SECTION 32 92 23 – SODDING

1. GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

A. DESCRIPTION: Provide sodded lawns as shown and specified. The work includes:

1. Soil preparation
2. Sodding lawns
3. Maintenance including weed control, mowing, adjusting irrigation schedules and controllers.
4. Soils test

1.2 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

1.3 SUBMITTALS

A. Prior to starting any work, the Contractor shall present to the District's Representative the following materials samples:

1. Sod growers certification of grass species. Identify source location.
2. Topsoil

1.4 DELIVERY, STORAGE AND HANDLING

A. Cut, deliver, and install sod within a 24-hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind, and dehydration prior to installation.
3. Do not tear, stretch or drop sod during handling and installation.

1.5 PROJECT CONDITIONS

A. Work notification: Notify District's Representative at least 7 working days prior to start of sodding operations.

B. Protect existing utilities, paving and other facilities from damage caused by sodding operations.

C. The irrigation system will be installed and operational prior to sodding. Locate, protect and maintain the irrigation system during the sodding operations. Repair irrigation system components damaged during sodding operations at the Contractor's expense.

2. PRODUCTS

2.1 MATERIALS

A. Sod:

1. Sunny areas: approved, nursery-grown dwarf turf-type fescue.

2. Shaded areas: approved, nursery-grown turf with blend of fescues and bluegrass. Submit formula for approval.

3. Athletic fields: Sports turf blend – 70% perennial Ryegrass and 30% Bluegrass.

B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil-borne insects. Provide sod uniform in color, leaf texture, and density and free of weeds, undesirable grasses, stones, thatch and extraneous material, viable and capable of growth and development when planted.

C. Fertilizer: Granular, non-burning product composed of not less than 50% organic, slow-acting, guaranteed analysis professional fertilizer.

3. PRODUCTS

3.1 INSPECTION

A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start sodding work until unsatisfactory conditions are corrected and accepted by District's Representative.

B. Provide opportunity for District's Representative to inspect quality of representative sample of certified turf grass.

C. Contractor to provide soils test and submit soil amendment recommendations to Landscape Architect or District's Representative for approval.

3.2 PREPARATION

A. Limit preparation to areas which will be immediately sodded.

B. Loosen topsoil areas to minimum depth of 6". Remove stones over 1" in any dimension and sticks, roots, rubbish and extraneous materials. In areas inaccessible to power equipment or limited due to tree roots, cultivate the the soil with hand tools.

C. Moisten entire area and amend soil with approved recommended amendments of Soils Test.

D. Cultivate compacted areas thoroughly by moistening as necessary. Rip and rototill to a depth of 6".

E. Rake surface and bring all areas to a smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions as required to drain. Regrade all areas not acceptable to the District's Representative. Provide necessary grades, 2% where possible, to promote drainage and prevent puddling. Finished grade shall be 1-inch below adjacent paving or curbs.

F. Soil to be damp prior to sodding. Do not install sod on dry soil.

G. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.3 INSTALLATION

**A.** Sodding:

1. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains and seeded areas.

2. Do not install sod on saturated or frozen soil.

3. Install initial row of sod in a straight line, beginning at the bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and tightly against previously installed row.

4. Peg sod on slopes greater than 3 to 1 to prevent slippage at a rate of 2 stakes per yard of sod.

5. Water sod thoroughly with a fine spray immediately after laying.

6. Roll with a lawn roller to ensure contact with sub-grade.

B. Sod indicated areas within contract limits and areas adjoining disturbed by construction operations which will not be seeded.

3.4 MAINTENANCE

A. Maintain sodded lawn areas for a period of at least 30 days after completion of sodding operation and formal written acceptance by the District's Representative.

B. It shall be the responsibility of the Contractor to fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following completion and acceptance of job.

C. The Contractor shall also guarantee all workmanship and materials furnished by him to be free of all defects and shall agree to replace at his expense, at any time within one year after installation is accepted, any and all defective elements that may be found.

D. Maintenance shall include watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides, rodent control and resodding until a full, uniform stand of grass, free of broad-leaved weeds, is achieved and accepted by the District's Representative.

E. Maintenance period for the irrigation system and sodding must overlap by a minimum of four (4) weeks.

3.5 CLEANING

A. Contractor shall maintain cleanliness in all areas of his operation, and will be held responsible for immediate removal of all debris in these areas. Keep premises free from accumulation of waste and rubbish. Daily, and at the completion of work, remove surplus

materials, rubbish and debris. The site must be maintained in a clean and safe condition. Repair damage resulting from sodding operations.

3.6 FINAL WALK THROUGH

A. Request the presence of the District's Representative 48 hours prior to the final walk through.

B. Inspection to determine preliminary and final acceptance of sodded lawns will be made by the District's Representative upon Contractor's notification.

C. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of broad-leaved weeds and disease.

## END OF SECTION

# SECTION 32 93 50 – TREE GRATES

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. Tree grates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each of the following:

1. Tree Grates, Frames, and Accessories: Manufacturer's standard size delivered to site for review, to verify design and color selected.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

1.6 WARRANTY

A. Special Warranty: Installer agrees to repair or replace tree grates that fail in materials and workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty performance.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of Substantial Completion.

a. 12 months.

PART 2 - PRODUCTS

2.1 TREE GRATES

A. Tree Grates: Manufacturer's standard two piece tree grates and frames.16 inch tree opening and ½ inch maximum slot openings (ADA compliant)

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ironsmith Inc.; 4836 ADA Tree grate with M4836F frame.
b. Barry Pattern & Foundry; B-TG710-3 Tree grate with steel angle frame.
c. Neenah Foundry; R-8710 Avenue Collection Tree Grate with steel angle frame.
d. Scapeworks, LLC; MT-4-N Monterey Tree Grate with steel angle frame.

2. Grates: ASTM A 48, Class 35 or better, gray-iron castings.
3. Frames: ASTM A 36 steel-angle, hot-dip galvanized, of shape, pattern, and size indicated.

B. Shape and Size: 48 inches square.

C. Finish: As fabricated (natural).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to tree grates, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

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

3.2 TREE GRATE INSTALLATION

A. Tree Grates: Install according to manufacturer's written instructions. Set grate segments flush with adjoining surfaces. Shim from supporting substrate with soil-resistant plastic. Maintain a 3-inch- minimum growth radius around base of tree; break away portions of casting, if necessary, according to manufacturer's written instructions.

**END OF SECTION 32 93 50**

# SECTION **33 05 00** - **COMMON WORK RESULTS FOR UTILITIES**

## 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 the following:
1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

### 1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

### 1.4 SUBMITTALS

A. Product Data: For the following:
1. Dielectric fittings.
2. Identification devices.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:
1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:
1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:
1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:
1. Description: MSS SP-107, PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
1. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
1. Description: Factory fabricated, union, NPS 2 and smaller.
a. Pressure Rating: 150 psig minimum at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:
1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
a. Pressure Rating: 150 psig minimum.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
      a. Pressure Rating: 150 psig minimum.
      b. Gasket: Neoprene or phenolic.
      c. Bolt Sleeves: Phenolic or polyethylene.
      d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
   1. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.
      a. Pressure Rating: 300 psig at 225 deg F.
      b. End Connections: Threaded.

F. Dielectric Nipples:
   1. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
      a. Pressure Rating: 300 psig at 225 deg F.
      b. End Connections: Threaded or grooved.

## 2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

## 2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
   1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
   2. Location: Accessible and visible.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

F. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

G. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

H. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.
1. Material: 0.032-inch- thick, polished brass.
2. Size: 1-1/2 inches in diameter, unless otherwise indicated.
3. Shape: As indicated for each piping system.

I. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

J. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/8 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

K. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

L. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

M. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
   1. Cement: ASTM C 150, Type I, portland.
   2. Density: 115- to 145-lb/cu. ft.
   3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
   4. Water: Comply with ASTM C 94.
   5. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
   1. NPS 2 and Smaller: Dielectric unions.
   2. NPS 2-1/2 to NPS 12: Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
   1. NPS 2 and Smaller: Dielectric couplings.
   2. NPS 2-1/2 to NPS 4: Dielectric nipples.
   3. NPS 2-1/2 to NPS 8: Dielectric nipples or dielectric flange kits.
   4. NPS 10 and NPS 12: Dielectric flange kits.

3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. 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 the Coordination Drawings.

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 to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
      a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
      b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

J. Verify final equipment locations for roughing-in.

K. Refer to equipment specifications in other Sections for roughing-in requirements.

## 3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

## 3.4 PIPING CONNECTIONS

A. 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. Install dielectric fittings at connections of dissimilar metal pipes.

## 3.5 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

## 3.6 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 09 91 00 "Painting and Finishing." Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

## 3.7 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
   1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
   2. Locate pipe markers on exposed piping according to the following:
      a. Near each valve and control device.
      b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
      c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
      d. At manholes and similar access points that permit view of concealed piping.
      e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
   1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
   2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

## 3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   2. 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 base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 03 30 00 "Cast-in-Place Concrete

## 3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 05 50 00 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1.

## 3.10 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

**END OF SECTION 33 05 00**

# SECTION **33 11 00** - **FACILITY WATER DISTRIBUTION 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 water-distribution piping and related components outside the building for water service and fire-service mains.

### 1.3 DEFINITIONS

A. LLDPE: Linear, low-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

### 1.4 SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
   2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
   3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. 1. Flush immediately prior to connecting to fire sprinkler systems.

G. NSF Compliance:
1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
1. Notify Architect and Owner no fewer than three business days in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Flanges: ASME 16.1, Class 125, cast iron.

2.3 PVC PIPE AND FITTINGS

A. PVC, Schedule 80 Pipe: ASTM D 1785.
   1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
   2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

B. PVC, AWWA Pipe: AWWA C900, Class 150 andClass 200, with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

## 2.4 JOINING MATERIALS

A. Refer to Section 33 05 00 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

## 2.5 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:
   1. Standards: ASTM A 674 or AWWA C105.
   2. Form: Sheet or tube.
   3. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, crosslaminated PE film of 0.004-inch minimum thickness.
   4. Color: Black.

## 2.6 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Non-rising-Stem, Metal-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
         1) Standard: AWWA C500.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Mechanical joint.
         4) Interior Coating: Complying with AWWA C550.

B. UL/FMG, Cast-Iron Gate Valves:
   1. UL/FMG, Non-rising-Stem Gate Valves:
      a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
         1) Standards: UL 262 and FMG approved.
         2) Minimum Pressure Rating: 175 psig.
         3) End Connections: Flanged.

C. Bronze Gate Valves:
   1. Non-rising-Stem Gate Valves:
      a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
         1) Standard: MSS SP-80.

## 2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
   1. Description: Sleeve and valve compatible with drilling machine.
      a. Standard: MSS SP-60.
      b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

c. Valve: AWWA, cast-iron, non-rising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. 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. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

## 2.8 DETECTOR CHECK VALVES

A. Detector Check Valves for Automatic Fire Sprinkler Systems:
1. Basis-of-Design Product: Subject to compliance with requirements, provide FEBCO; SPX Valves & Controls; Series 800 or a comparable product by one of the following:
a. Ames Fire & Waterworks; a division of Watts Regulator Co.
b. Badger Meter, Inc.
c. Victaulic Company of America.
d. Viking Corporation.
e. Watts Water Technologies, Inc.
f. Wilkins; Zurn Industries LLC.
2. Description: Detector check shall consist of a single spring-loaded swing check in parallel with a bypass meter assembly. Seat rings shall be bronze, bolted to the valve bodies with an elastomer seal. The main check assembly shall be hinge guided. Head loss through the assembly shall not exceed 3 psi at velocities from zero up to and including 15fps. Mainline check body and cover shall be manufactured of Ductile Iron ASTM A536 Grade 6545-12. Ductile Iron bodies shall be flanged ANSI B16.42, Class 150 and fusion epoxy coated 8 mils minimum to meet A.W.W.A. C550-90. Disc shall be ruber encapsulated ductile iron. Set valve to allow minimal water flow through bypass meter when major water flow is required.
a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 175 psig (maximum).
c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

## 2.9 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Cast Iron Pipe Co.; American Flow Control Div.: American Darling Model B-84-B
b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary; Pacer WB-87.
c. Mueller Co.; Water Products Div.: Model #A423 traffic type.
2. Description: Freestanding, with one NPS 4 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
a. Standard: AWWA C502.
b. Pressure Rating: 250 psig.

c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.
e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f. Exterior Finish: Safety Yellow alkyd-gloss enamel paint, unless otherwise indicated.

2.10 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Elkhart Brass Mfg. Co., Inc.
b. Fire End & Croker Corporation.
c. Guardian Fire Equipment, Inc.
d. Kidde Fire Fighting.
e. Potter Roemer.
f. Reliable Automatic Sprinkler Co., Inc.
2. Description: Exposed, with cast-bronze or cast-brass body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded inline outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet.
a. Standard: UL 405.
b. Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
c. Inlet Alignment: Inline, horizontal.
d. Finish: Cast-bronze or cast-brass.
e. Body Marking: "AUTO SPKR."

2.11 ALARM DEVICES

A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.

B. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS **3** shall be the following:
   1. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

F. Underground water-service piping NPS 4 to NPS 8 shall be the following:
   1. NPS 4 and NPS 6: NPS 6 PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 mechanical-joint, ductile-iron fittings; and gasketed joints.
   2. NPS 8: PVC, AWWA Class 200 pipe; mechanical-joint, ductile-iron fittings; and gasketed joints.

G. Aboveground Water-Service Piping NPS 3/4 to NPS 3 shall be the following:
   1. Hard copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

H. Vault Water-Service Piping NPS 3/4 to NPS 3 shall be the following:
   1. PVC, Schedule 80 pipe; PVC, Schedule 80 threaded fittings; and threaded joints.

I. Aboveground water-service piping NPS 4 to NPS 8 shall be the following:
   1. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

J. Vault water-service piping NPS 4 to NPS 8 shall be any of the following:
   1. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
   2. PVC, Schedule 80 pipe; PVC, Schedule 80 threaded fittings; and threaded joints.

K. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
   1. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.

L. Aboveground Fire-Service-Main Piping NPS 4 to NPS 12 shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

## 3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, non-rising-stem, metal-seated gate valves with valve box.
   2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, non-rising-stem gate valves with indicator post.
   3. Use the following for valves in vaults and aboveground:
      a. Gate Valves, NPS 2 and Smaller: Bronze, non-rising stem.
      b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Make connections larger than NPS 2 with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

B. Comply with NFPA 24 for fire-service-main piping materials and installation.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

D. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

E. Bury piping with depth of cover over top at least 30 inches and according to the following:
   1. Under Driveways: With at least 36 inches cover over top.

F. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

G. Extend water-service piping and connect to water-supply source and building-water-piping systems at 5 feet outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping to 5 feet of building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

H. Sleeves are specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

I. Mechanical sleeve seals are specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. See Section 21 13 00 "Fire Suppression Sprinklers" for fire-suppression-water piping inside the building.

L. See Section 22 10 05 "Plumbing Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Section 33 05 00 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:
   1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
   2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
   3. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.

## 3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Heat-fused joints.
   6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
   4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

## 3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

## 3.9 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on concrete piers.

3.10 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. 1.Provide physical damage protection (bollards) where applicable, retaining a 3'-0" clearance (minimum) around fire hydrants and other equipment. Pipe bollards are specified in Section 05 50 00 "Metal Fabrications."

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.11 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install at detector check assembly as indicated on drawings.

B. Install protective pipe bollards on two sides of each fire department connection (when required and shown on drawings). Pipe bollards are specified in Section 05 50 00 "Metal Fabrications."

3.12 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.
1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.

C. Locking and Sealing: Secure unsupervised valves as follows:
1. Valves: Install chain and padlock on open OS&Y gate valve.

D. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Section 28 31 00 "Fire Alarm Integrated Safety System."

3.13 CONNECTIONS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

D. Ground equipment according to Section 26 05 00 "Basic Materials and Methods."

3.14 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test per 2016 California Plumbing Code Section 609.4 “Testing.”
   1. Remake leaking joints with new materials and repeat test until leak free.

C. Prepare reports of testing activities.

3.15 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 33 05 00 "Common Work Results for Utilities" for identifying devices.

3.16 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

**END OF SECTION 33 11 00**

# SECTION **33 31 00** - **FACILITY SANITARY SEWERS**

## 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 and fittings.
   2. Nonpressure couplings.
   3. Cleanouts.
   4. Manholes.

### 1.3 SUBMITTALS

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

B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

C. Field quality-control reports.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

### 1.5 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage 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 and Owner no fewer than three days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:
1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:
1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:
1. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:
1. 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.
2. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty, and Extra-Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.4 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: Class “B” concrete base with 8 inch minimum thickness below pipe and with top of base at 3 inches minimum above top of pipe and at least 1 foot larger than outside diameter of manhole.
5. Riser Sections: 5-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Concentric-cone; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Grade Rings: Reinforced-concrete rings, 6- to 12-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

## 2.5 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

# PART 3 - EXECUTION

## 3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

## 3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure, drainage piping according to the following:
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
   2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
   3. Install piping with 36-inch minimum cover.
   4. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

## 3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
   2. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

## 3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

E. Install manhole-cover inserts in frame and immediately below cover.

## 3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

## 3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. 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.

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. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 22 05 00 "General Plumbing Systems."

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

## 3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed.
   1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Backfill to grade according to Section 31 20 00 "Earth Moving."

## 3.9 IDENTIFICATION

A. Comply with requirements in Section 31 20 00 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects. Contractor shall perform either the Hydrostatic Test or the Air Test on the pipes.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
      a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
      b. Close openings in system and fill with water.
      c. Purge air and refill with water.
      d. Disconnect water supply.
      e. Test and inspect joints for leaks.
   6. Air Tests: Test sanitary sewerage according to requirements of UNI-B-6.
      a.
   7. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.11 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

**END OF SECTION 33 31 00**

# SECTION **33 41 00** - **STORM UTILITY DRAINAGE 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 and fittings.
2. Nonpressure transition couplings.
3. Cleanouts.
4. Drains.
5. Catch basins.

### 1.3 SUBMITTALS

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

B. Shop Drawings:
1. Storm water system. Include plans, elevations, sections, details, frames, covers, and grates.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between catch basins, piping, and proximate structures.

D. Field quality-control reports.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle catch basins according to manufacturer's written rigging instructions.

### 1.5 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 and Owner no fewer than twothree days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Ring-Type, Flexible Couplings:
1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.3 CLEANOUTS

A. Plastic Cleanouts:
1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.4 DRAINS

A. Cast-Iron Area Drains:
1. Description: ASME A112.6.3 gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
2. Top-Loading Classification(s): Medium and Heavy Duty.
3. Grates shall have 1/2 inch max. opening per 2010 CBC path of travel requirements.

2.5 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

## 2.6 CATCH BASINS

A. Standard Precast Concrete Catch Basins:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Riser Sections: 4-inch minimum thickness, 12-inch square, and lengths to provide depth indicated.
3. Top Section: 4-inch minimum thickness, 12-inch square, and lengths to provide depth indicated.
4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.
1. Size: 15 by 15 inches with 1/2 inch max. opening per 2010 CBC path of travel requirements.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

# PART 3 - EXECUTION

## 3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

## 3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
5. Install PE corrugated sewer piping according to ASTM D 2321.
6. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

## 3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
   2. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
   3. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
   4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

## 3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from drainage pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in drainage pipe.
   1. Use Medium-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.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 24 by 24 by 6 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

## 3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use Medium-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.

B. Embed drains in 4-inch minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

## 3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

## 3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

## 3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 05 00 "General Plumbing Systems."

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
      a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
   4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Shielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

## 3.9 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
   1. Remove manhole or structure and close open ends of remaining piping.
   2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 31 20 00 "Earth Moving."

## 3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

## 3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping according to ASTM F 1417.
      c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

**END OF SECTION 33 41 00**