

PROJECT MANUAL

for

Hollywood Park Elementary School Modernization

at

4915 Harte Way
Sacramento, California 95822

SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
Sacramento, California

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DSA Submittal

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PROJECT MANUAL AND SPECIFICATIONS
FOR
SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

HOLLYWOOD PARK ELEMENTARY SCHOOL
MODERNIZATION

DSA Application No. 02-122829

SIGNATURE PAGE

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PROJECT MANUAL AND SPECIFICATIONS
FOR
**SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
HOLLYWOOD PARK ES MODERNIZATION**

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ADDITIONAL REQUIREMENTS FOR DSA-REVIEWED PROJECTS

PART 1 - GENERAL

1.01 GENERAL

- A. The following additional requirements apply to this Project, which is being reviewed by the Division of the State Architect (DSA).

1.02 ADDITIONAL REQUIREMENTS

- A. The Contractor shall maintain full compliance with the requirements specified in Parts 1 thru 5 and Part 9, Title 24, California Code of Regulations (CCR). Unless otherwise indicated or specified, work shall be performed in full conformance with the latest edition of applicable regulatory requirements. All work shall be performed in accordance with the rules and regulations, Title 24, Parts 1-5 and Part 9, California Code of Regulations, and Division of the State Architect, and a copy shall be kept on the job at all times during construction. The codes adopted by the City, County, State and Federal agencies shall govern minimum requirements for this Project. The Contractor shall notify the District of any conflicts between the requirements of the Contract Documents and the requirements of this paragraph.
- B. In addition to the duties specified in the Contract Documents, the duties of the Contractor shall be in accordance with the requirements specified in Section 4-343 of Part 1, Title 24, California Code of Regulations.
- C. In addition to the duties specified in the Contract Documents, the duties of the Architect and the Architect's consultants shall be in accordance with the requirements specified in Section 4-341 of Part 1, Title 24, CCR.
- D. Neither DSA, nor the decisions and instructions rendered by DSA, are subject to arbitration proceedings.
- E. Architect shall notify DSA at start of construction in accordance with 4-341 of Part 1, Title 24, CCR.
- F. All Addenda and applicable Contract Change Documents (CCD) shall be signed by the District and the Architect/Engineer and submitted for DSA approval. Do not begin work under a written order until a CCD that requires DSA approval has been submitted to and approved by DSA in accordance with Section 4-338 of Part 1, Title 24, CCR.
- G. If a Field Change Directive (FCD) or any other field directed change to the Contract Documents which affects ACS, FLS, or SS, it shall be submitted to DSA for review as a CCD. Also, If DSA approval is required for a CCD, it will be so noted on the CCD. In such cases, do not begin work under a written order until the FCD or CCD has been submitted to and approved by DSA in

accordance with Section 4-338 of Part 1, Title 24, CCR. Substitutions affecting DSA regulated items are changes to the Contract Documents and shall be considered CCDs. DSA review of CCDs is required, and they shall be approved by DSA prior to fabrication and installation. FCDs and CCDs shall be signed by AOR, SEOR (if applicable), and DSA in accordance with 4-338(c), Part 1, DSA IR A-6.

- H. Contractor shall submit verified reports in accordance with Sections 4-343(c) of Part 1, Title 24, CCR. Architect shall submit verified reports in accordance with Sections 4-341(f) of Part 1, Title 24, CCR.
- I. DSA may supervise construction, reconstruction, or repair in accordance with Section 4-334 of Part 1, Title 24, CCR.
- J. Construction shall be observed by a full-time Project Inspector employed by the District, approved by the Architect, Structural Engineer and DSA in accordance with Sections 4-333(b) and 4-342 of Part 1, Title 24, CCR.
- K. Testing requirements of the District's Testing Laboratory shall be in accordance with Section 4-335 of Part 1, Title 24, CCR.
- L. Special inspection of masonry construction, glued laminated lumber, wood framing using timber connections, ready-mixed concrete, high strength steel bolt installation, welding, and mechanical and electrical work shall be as required by Section 4-333(c) of Part 1, Title 24, CCR. The costs of special inspection will be paid for by the District. Nothing in this paragraph shall limit the District's rights under Division 1 - General Conditions.
- M. The intent of these Drawings and Specifications is that the work of the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the Contract Documents wherein the finished work will not comply with Title 24, California Code of Regulations, a change order, or separate set of plans and specifications, detailing and specifying the required work shall be submitted to and approved by DSA before proceeding with the work.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 01 57 13

EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. General: Provide all materials, equipment and labor necessary to furnish and install straw wattles at locations shown on the Drawings and on Contractors Storm Water Pollution Prevention Plan.
- B. Storm Water Pollution Prevention Plan: Contractor will be required to prepare a Storm Water Pollution Prevention Plan (SWPPP), and submit to the State Water Resource Control Board to obtain Notice of Intent approval and a WDID number. Comply with State Water Resources Control Board requirements. The SWPPP shall be provided by the Contractor prior to the start of work. The SWPPP shall be tailored to the contractor's approach to the work in this contract. The SWPPP shall be prepared by a Qualified SWPPP Developer (QSD). The Contractor shall as a minimum address:
 - 1. Cut and fill operations.
 - 2. Temporary stockpiles.
 - 3. Vehicle and equipment storage, maintenance and fueling operations.
 - 4. Concrete, plaster, mortar and paint disposal.
 - 5. Dust control.
 - 6. Tracking of dirt, mud on off-site streets.
 - 7. Erosion Controls
 - 8. Sediment Controls

1.02 QUALITY ASSURANCE

- . General: Comply with governing codes and regulations.

1.03 SUBMITTALS

- A. SWPPP: Contractors Qualified SWPPP Developer (QSD) shall submit to the State Water Resources Control Board via Storm water Multi Application and Report Tracking System (SMARTS) and obtain a Notice of Intent and WDID number prior to beginning work on site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Straw Wattles: Shall be new manufactured straw roles in compliance with state requirements for sediment control.
- A. Filter Bag: Shall be as required by local jurisdiction.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All BMPS shall be installed per the drawings, CASQA standards and as required by the SWPPP.

3.02 MAINTENANCE AND REMOVAL:

- A. General: Maintain and repair existing and new erosion control facilities throughout the construction period. Remove silt build up at straw wattles and/or silt fences as needed. Repair damage to earth slopes and banks. Erosion control measures shall be left in place until hydroseed is placed.
- B. Monitoring: Based on determined Risk Level of Contractor's SWPPP provide monitoring of erosion and sediment control measures before, during and after storm events. Site monitoring shall be performed by a Qualified SWPPP Practitioner. Update SWPPP continuously throughout construction period and provide reporting and testing as required by the current NPDES permit. Testing and reporting of turbidity and ph will be required for a project determined to be Risk Level 2. Contractor's QSD/QSP will be required to prepare AdHoc reports of all testing on the State Water Resources Control Board's SMARTS database
- C. Cleaning: Keep area clean of debris.
- D. Remove all sediment control measures following site stabilization.
- E. The Contractor's QSD and QSP will be responsible for preparing and gaining approval of the annual report(s) and Notice of Termination on the State Water Resources Control Board's SMARTS database following project completion.

END OF SECTION

SECTION 02 41 00

SITE DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00 - Construction Facilities and Temporary Controls.
3. Section 01 50 13 - Construction Waste Management and Disposal.
4. Section 31 00 00 - Earthwork.
5. Section 31 13 16 - Tree Protection.

1.02 REGULATORY REQUIREMENTS

- A. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
- B. Coordinate clearing Work with utility companies
- C. Maintain emergency access ways at all times.
- D. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.03 SUBMITTALS:

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.04 EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

1.05 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Safety Precautions Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.
 - 1. Protect existing items which are not indicated to be altered. Protect utilities designated to remain from damage.
 - 2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on drawings.
 - 3. Protect benchmarks from damage or displacement.
- D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.
- E. Fire Safety: The contractor shall conform to chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition", at all times during the construction process. A copy of this chapter can be provided.
- F. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- G. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- H. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions of work in place before beginning work, report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.

3.02 PREPARATION

- A. Scheduling:
 - 1. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress.
- B. Hazardous Materials:
 - 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
 - 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.
- C. Utility and Service Termination
 - 1. Locate and identify existing utility, service and irrigation system components affected by work of this contract. Review existing record drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
 - 2. Prior to beginning any demolition, properly disconnect all water, gas and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
 - 3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this contract.
 - 4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project Record Documents.
- D. Verify that existing plant life and features designated to remain are tagged or identified.
 - 1. The Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by the Owner and all protective measures are in place.

- E. Coordinate the time and duration of all system disconnects with Owner.

3.03 DEMOLITION

A. General Requirements

1. Clear areas required for access to site and execution of Work, including pavements, structures, foundations, vegetation, trash and debris.
2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.

B. Fixture and Equipment Removal:

1. Remove existing fixtures and equipment as identified and shown on drawings and required by Architect.
2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
3. Remove all conductors from conduit at all abandoned circuits.

3.04 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

- A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts and similar components.
 1. Review all contract documents showing crossing paths and potential points of interference.
 2. Pothole or determine by other means the accurate depth and location of such utilities.
 3. Incorporate all costs required to complete work under this contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this contract.
 4. No additional cost to the Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on contract drawings or can be reasonably inferred from surface conditions or components.
- B. Remove all conductors from conduit at all abandoned electrical circuits.
- C. Seal off ends of all piping, drains and other components as directed by Architect and serving utility.
- D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components.

1. Re-circuit all electrical as required.
2. Re-circuit all landscape irrigation valving and control systems as required.
3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets and piping. Fine grade to maintain proper drainage flow pattern to drains.

E. Demolish structure in an orderly and careful manner.

1. Use of explosives prohibited.

3.05 SITE PAVEMENT REMOVAL

A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings.

1. Remove all paving by saw-cutting.
2. Remove concrete paving and curbing at locations shown on drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.

B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings.

1. Remove all paving by saw-cutting.
2. Remove paving assembly as required to expose subgrade.

3.06 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

A. Clearing, grubbing, and planting demolition.

1. Remove grass and grass roots to a minimum depth of two inches below existing grade.
2. Remove all shrubs, plants and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
3. Remove only those trees which are specifically designated for removal, or as shown on the drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than 1 inch in diameter to a depth of two feet below existing or finished grades, whichever is lower and a minimum of five feet beyond the edge of paving, structure, wall or walkway.
4. Hand cut existing tree roots over 1 inch in diameter as necessary for trenching or other new construction, apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 31 00 00.

8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.
9. Keep drains, catch basins, surface drainage courses and related drainage system components clear of debris and construction materials.
10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.07 DISPOSAL

Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

- A. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.
- B. It is recommended that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).
- C. Burning and Burying of Materials: NOT ALLOWED.
- D. Haul Routes:
 1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance, post flagmen for the safety of the public and workmen.
 2. Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.
- E. Remove demolished materials and debris from site on a daily basis.

3.08 CLEANING

- A. Upon completion of work of this Section promptly remove from the working area all scraps, debris.
- B. Clean excess material from surface of all remaining paved surfaces and utility structures.
- C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
2. Openings for other affected work.
3. Form accessories.
4. Stripping forms.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 03 20 00 – Concrete Reinforcing.
3. Section 03 30 00 – Cast-In-Place Concrete.
4. Section 32 16 00 – Site Concrete.

1.02 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19A.
- B. ACI 301 - Specifications for Concrete Construction.
- C. PS-1-95 - Construction and Industrial Plywood.

1.03 SYSTEM DESCRIPTION

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.04 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301.

B. Regulatory Requirements:

1. Conform to CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Plywood: PS-1-95, BB Plyform grade, Class I, Exterior classification. Supply in large sheets of adequate thickness to support the imposed loads, but in no case less than 5/8" thick.
- B. Lumber: Douglas Fir species; construction grade; with grade stamp clearly visible. Forms may be used for concrete surfaces that are unexposed and require no further surface applied materials. Lumber, if used, shall be clean and sound 2x (height as required) No. 2 grade or better.
- C. Form Coating: Form shall be coated with nongrain-raising and non-staining types of form coating that will not leave a residual matter on the face of the concrete or adversely affect proper bonding of any subsequent paint or other surface applications. Form coating containing mineral oils or other non-drying materials will not be permitted for any concrete work.
- D. Form Ties: Snap off metal of fixed length: leaving no metal within 1-1/2 inches of surface and no fractures, spalls or other surface defects larger than one-inch diameter; manufactured by Burke, Dayton Superior, or accepted equal.
- E. Spreaders: Metal (no wood permitted).

2.02 ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than 1 inch diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Fillets for Chamfered Corners: Wood strips type; 3/4 x 3/4-inch size; maximum possible lengths.
- D. Flashing Reglets: 26-gauge thick galvanized steel; longest possible lengths; release tape sealed slots; with alignment splines for joints; securable to concrete formwork; Type CO reglet manufactured by Fry Reglet www.fryreglet.com.
- E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and measurements before proceeding with formwork.

3.02 PREPARATION

- A. Obtain Architect's approval for use of earth forms for footings.
- B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- C. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.03 APPLICATION

- A. Form Release Agent
 - 1. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
 - 2. Do not apply form release agent where concrete surfaces are scheduled to receive applied coverings which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.04 CONSTRUCTION

- A. Build and erect forms to conform to the required shapes, patterns, lines, grades and dimensions indicated. Forms shall be substantial and tight to prevent any leakage of mortar, properly braced and tied together to maintain their position and shape. Forms shall not deflect under the dead load weight of the plastic concrete or construction loads. Joints in forming material shall be butted tightly and shall bear on solid construction. Provide tool edges where indicated. Completed form work to be checked for grade and alignment to tolerances not exceeding 1/4" in 10'-0" for top of forms and not more than 1/4" in 10'-0" for vertical face.
- B. Cast-in Items: Set in formwork all new sleeves, inserts, anchors, and similar items furnished and required under the work of other sections. Brace, anchor and support cast-in-items to prevent displacements and distortions.
- C. Clean forms after each use and coat with release agent as required.
- D. Space clamps, ties, hangers, and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.
- E. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

- F. Build in securely braced temporary bulkheads, keyed as required, at approved locations of construction joints.
- G. Slope tie-wires downward to outside of wall.
- H. During and immediately after concrete placing, tighten forms, posts, and shores. Readjust to maintain grades, levels, and camber.
- A. Inserts, Embedded Parts, And Openings
 - 1. Provide formed openings where required for work embedded in or passing through concrete.
 - 2. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
 - 3. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.
- B. Earth Forms
 - 1. Construct wood edge strips at top sides of excavations as indicated on drawings.
 - 2. Provide forms for footings and foundation walls wherever concrete cannot be placed against solid earth.
 - 3. Remove loose dirt and debris from form area prior to concrete placement.
 - 4. Concrete for foundations may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Architect (Structural Engineer) subject to the approval of The Division of the State Architect.
 - 5. When earth formed foundations are used, the minimum formwork shown on the drawings is mandatory to insure clean excavations prior to and during concrete placement.
 - 6. Provide 3-1/2-inch-high starter wall for all concrete and masonry walls below grade.
- C. Form Removal
 - 1. Do not remove forms and bracing until concrete has sufficient strength to support its own weight and imposed loads.
 - 2. Do not damage concrete surfaces during form removal.
 - 3. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.
 - 4. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.
 - 5. Forms shall remain in place for not less than the following periods of time. These periods represent minimum cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
 - a. Vertical forms of foundations and walls: 5 days.
 - b. Slab edge screens or forms: 7 days.

3.05 CLEANING

- A. Clean forms to remove foreign matter as erection proceeds.
- B. Ensure that water and debris drain to exterior through clean-out ports.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Reinforcing steel bars, welded steel wire fabric fabricated steel bar or rod mats for cast-in-place concrete.
2. Support chairs, bolsters, bar supports, and spacers, for supporting reinforcement.
3. Fibrous secondary reinforcement for light weight concrete topping.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 03 10 00 – Concrete Forming and Accessories.
3. Section 03 30 00 – Cast-In-Place Concrete.
4. Section 32 16 00 – Site Concrete.

1.02 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Chapter 19A (ACI 318).
- B. ACI 301 - Specifications for Concrete Construction.
- C. ACI 315 (SP-66) – Guide to Presenting Reinforcing Steel Design Details.
- D. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- E. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- F. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- G. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- H. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
- I. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.

J. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

K. CRSI - Manual of Practice.

L. CASI - Placing Reinforcing Bars.

1.03 QUALITY ASSURANCE

A. Perform concrete reinforcement work in accordance with CASI Manual of Standard Practice.

B. Conform to ACI 301 and ACI 315 (SP-66).

C. Conform to CBC California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit mill test certificates of supplied concrete reinforcing, indicating physical and chemical analysis, to testing laboratory.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Items as identified on the drawings and as otherwise specified herein.

A. Reinforcing Bars: ASTM A615 / A615M-09b with Supplement S1, marked "S", Grade 60 for #4 bar and larger, Grade 40 for bars smaller than #4.

B. Welded Reinforcement: ASTM A706, Grade 60, deformed bars, unfinished.

C. Welded Steel Wire Fabric: ASTM A185 plain type; coiled rolls; uncoated finish. Furnish 6x6 W2.1xW2.1 welded wire fabric in flat sheets; rolls will not be allowed.

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

2.02 ACCESSORIES

A. Tie Wire: Minimum 16-gauge annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture. Comply with CRSI "Recommended Practice for Placing Bar Supports, Specifications and Nomenclature, Latest Edition".

- C. Chairs, Bolsters, Bar Supports, Spacers Adjacent to Architectural Concrete Surfaces: Plastic coated sized and shaped as required. Wood is not permitted as supports for reinforcing. Concrete dobies allowed at foundations and footings only.

2.03 FABRICATION

- A. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of the bars for bending will not be permitted.
 - 1. Spacers and chairs shall be as specified or detailed and spaced such that steel reinforcement will be carried without deflection. Chairs shall center reinforcing vertically at center of slab thickness.
 - 2. Concrete blocks may be used to support bottom layer of steel in floor slabs on grade
 - 3. Bars shall be in long lengths with laps and splices as shown. Offset laps 8'-0" in adjacent bars. Place steel with clearances and cover as shown. Bar laps shall be as indicated on the drawings. Tie all laps and all intersections with specified wire. Maintain clear space between parallel bars not less than 1-1/2 times nominal diameter for round bars, or twice side dimension for square bars, but in no case shall clear space be less than 1-1/2", nor less than 1-1/2 times maximum size concrete aggregate.
 - 4. Install welded wire fabric in lengths as long as possible. Lap adjoining pieces at least one full mesh and lace splices with wire ties. Offset laps of adjoining widths to prevent continuous laps in either direction.
 - 5. Cut bars true to length with ends square and free of burrs.
- B. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.
- C. Welding of reinforcing bar shall be performed only where indicated on plans and in compliance with AWS D1.4. All welding of reinforcement is to be inspected in accordance with CBC Table 1705A.2.1, Item 5(b).
- D. Fabricate in accordance with ACI 315 (SP-66), providing concrete cover specified in Section 03 31 00.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.
- C. Weld reinforcing bars in accordance with AWS D1.4.

2.04 SOURCE QUALITY CONTROL AND TESTING

- A. Source Quality Control and Testing will be performed under provisions of Section 01 45 00 and as required by the Division of the State Architect and District Inspector.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
- C. Mix fibrous reinforcement into concrete material according to Section 03 30 00.
- D. Do not displace or damage vapor barrier required by Section 03 30 00.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 00 and as required by the Division of the State Architect and District Inspector.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Concrete Formwork.
2. Reinforcement of Concrete.
3. Concrete Placing and Finishing.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 03 10 00: Concrete Forming and Accessories.
3. Section 03 20 00: Concrete Reinforcing.
4. Section 03 35 45: Concrete Finishing – Polished Concrete.
5. Section 06 10 00: Rough Carpentry.
6. Section 07 26 00: Vapor Retarders.
7. Section 09 65 00: Resilient Flooring – Vinyl Composition Tile (for floor flatness requirements).
8. Section 09 65 19: Resilient Flooring – Sheet Vinyl (for floor flatness requirements).
9. Section 09 68 13: Carpeting (for floor flatness requirements).
10. Section 32 16 00: Site Concrete.

1.02 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations Title 24, Part 2, Chapter 19A.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ACI 117-10 - Specification for Tolerances for Concrete Construction and Materials.
- D. ACI 211.1-91 - Standard Practice for Selecting Proportions for Normal Weight, Heavy Weight and Mass Concrete.
- E. ACI 301-16 - Specifications for Structural Concrete for Buildings.
- F. ACI 302.1R-15 - Guide to Concrete Floor and Slab Construction.
- G. ACI 304R-00 - Guide for Measuring, Mixing, Transporting and Placing Concrete.

- H. ACI 305R-10 - Hot Weather Concreting.
- I. ACI 306R-16 - Cold Weather Concreting.
- J. ACI 308-16 - Standard Practice for Curing Concrete.
- K. ACI 309R-05 - Guide for Consolidation of Concrete.
- L. ACI 318-14 - Building Code Requirements for Structural Concrete.
- M. ASTM A615 / A615M-09b - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- N. ASTM C33 / C33M-08 - Concrete Aggregates.
- O. ASTM C94 / C94M-09a - Ready-Mixed Concrete.
- P. ASTM C114-09b - Methods of Chemical Analysis of Hydraulic Cement.
- Q. ASTM C150 / C150M-09 - Portland Cement.
- R. ASTM C260-06 - Air Entraining Admixtures.
- S. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity.
- T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- U. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
- V. ASTM C494 / C49M-08a - Chemical Admixtures for Concrete.
- W. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.
- X. ASTM C595/C595M-20 - Standard Specification for Blended Hydraulic Cements.
- Y. ASTM C618-19 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- Z. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.
- AA. ASTM C989/C989M-18a - Standard Specification for Slag Cement for Use in Concrete and Mortars
- BB. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- CC. ASTM C1602/C1602M-22 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

- DD. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- EE. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- FF. ASTM E96 - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
- GG. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- HH. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- II. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- JJ. ASTM E1745 - Standard Specifications for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- KK. ASTM F710 - Standard Practice for Preparing Concrete Floor to Receive Resilient Flooring.
- LL. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- MM. National Ready Mix Concrete Association - Plant Certification Program.

1.03 QUALITY ASSURANCE

- A. All Concrete for the project shall be controlled concrete of specified strengths, of uniform color, and free from defects liable to adversely affect strength, durability or appearance of the structure or its components.
- B. Requirements of Regulatory Agencies: The quality and design of structural concrete shall comply with the requirements of the California Building Code, except where more stringent requirements are specified.
- C. Workmanship: Materials and methods used for the production and placement of concrete shall be such as to assure the specified quality and shall conform to applicable requirements of the Building Code for Reinforced Concrete (ACI 318) of the American Concrete Institute, except as otherwise specified in this Section.
 - 1. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Project Inspector. Work not so inspected is subject to uncovering and replacement at no expense to the Owner.

2. Proper installation of partitions and equipment requires the floor finish to be level and smooth throughout. Extreme care shall be exercised during all floating and troweling operations to check levels often.
 3. Any concrete work which does not comply with tolerances and elevations shown on drawings will be cause for rejection of all work affected, and, if so rejected, such work shall be removed and replaced at no increase in cost to the Owner.
- D. Removal and replacement of Defective Concrete Surfaces shall be done in the following manner when, in the opinion of the Architect, such defects may be removed and replaced at no additional cost to the Owner.
1. Rock pockets, voids, spalls, cracks (superficial and structural) and exposed reinforcing shall be removed and replaced.
 2. Floor surfaces which exceed the allowable variation in plane or level as specified herein shall be ground, filled, or replaced to obtain the level and plane required. Fill materials, where required, shall be of type approved by the Architect.
 3. Surfaces which are not plumb and square, or which do not conform to the lines and levels indicated shall be removed and replaced.
- E. Uniformity of Concrete: All aggregates shall be measured by weight and the proportion of water to cement shall be accurately controlled by either automatic measuring devices or calibrated containers. All concrete placed shall be uniform strength and color appearance as well as surface texture.
- F. Screeds shall be provided at all construction joints as required to ensure installation of concrete to lines and elevations noted.
- G. Ready-Mixed Concrete: ASTM C94 / C94M-09a except as otherwise specified herein. Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Continuous Batch Plant inspection is required per CBC Section 1705A.3.3. Contractor may request waiver of batch plant inspection in accordance with CBC Section 1705A.3.3.1 provided the following is met:
1. Approved Testing Laboratory shall check the first batching for each class of concrete and furnish mix proportions to the Licensed Weighmaster.
 2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
 3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to the Division of the State Architect (DSA).
 4. Do not add water at the site to concrete mixes with a maximum specified WCR unless the water content at batch time provides for a WCR less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the Mix Design and Certification by the mix preparer.
 5. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.

- H. Concrete Preplacement Inspection: Concrete shall not be poured until the forms, reinforcement, and preparations are complete and have been reviewed by the Project Inspector.
- I. Tests: For structural concrete, the Testing Lab shall take four (4) test cylinders of concrete each day for every 50 cubic yards of concrete or fraction thereof being placed. Cylinders shall be made and stored as per instructions given by the testing laboratory and shall be in accordance with ASTM Specifications C-31 / C31M-09 and C-39 / C39M-09a. Cylinders shall be tested for ultimate compressive strength of concrete with one cylinder tested at the age of 7 days and two (from the same batch) to be tested at the age of 28 days, with one cylinder held as a spare for future testing if needed. Tests shall be made by a recognized test laboratory selected by the Owner and approved by the Architect.
 - 1. Cylinders not meeting the required design stresses shall indicate defective concrete and such concrete shall be removed and replaced at no increase in cost to the Owner. Core tests requested by the Contractor to establish design stresses, when cylinder tests indicate defective concrete, shall be paid for by the Contractor.
 - 2. Batch plant inspection as required by the DSA Structural Tests and Inspections Form SSS 103-1.
- J. Floor Flatness: Provide certification of floor slab flatness per the requirements of Part 3 below.
- K. Preinstallation Meetings.
 - 1. Preinstallation Conference: Conduct conference at Project site.
 - a. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - 1) Contractor's superintendent.
 - 2) Independent testing agency responsible for concrete design mixtures.
 - 3) Ready-mix concrete manufacturer.
 - 4) Concrete Subcontractor.
 - 5) Special concrete finish Subcontractor.
 - 6) Inspector.
 - 7) Owner's Representative.
 - 8) Architect.
 - b. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, and concrete protection.
 - c. Sign-in sheet shall be provided at time of meeting to document attendees.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.

- B. Manufacturer's Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, chemical floor hardeners, and others as may be requested by the Architect.
- C. Shop Drawings: Shop drawings sheet size shall be 24" x 30" minimum.
 - 1. Reinforcing Steel: The correctness of the bending diagrams is the responsibility of the Contractor. Identify such shop drawings with a reference thereon to sheet and detail numbers from the contract drawings. No reinforcing steel shall be fabricated without approved shop drawings.
 - 2. Construction joint layout per Part 3 below. Contractor to submit plan based upon design team's layout as shown on drawings. Provide verification that the joint layout will limit the risk of slab cracking. Plans shall include control, and expansion joints.
- D. Concrete Mix Design: Submit proposed mix design prepared by concrete supplier. Mix design must be submitted to Owner for review and acceptance by a recognized independent testing lab, for all structural concrete.
- E. Historical test data on all proposed mix designs including 28-day strength reports, and verification of aggregate and concrete shrinkage.
- F. Test reports for Floor Flatness and Floor Levelness shall be submitted for review after first slab has been poured and prior to subsequent slabs being poured.

1.05 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required by construction activities.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150 / C150M-09, Type II, low alkali. All cement used shall be of one manufacturer.
 - 1. Use Type IIA cement if pumping of concrete is selected and permitted for placing of concrete.
 - 2. All cement shall contain not more than 0.6 percent total alkali when calculated as sodium oxide as determined by "Methods of Chemical Analysis of Hydraulic Cement", ASTM C114-09b.
- B. Blended Cement: ASTM C595/C595M-20, Type IL (MS or (HS)).
 - 1. All cement shall not contain more than 0.6 percent total alkali when calculated as sodium oxide as determined by "Methods of Chemical Analysis of Hydraulic Cement", ASTM C114-09b.
- C. Supplementary Cementitious Materials:
 - 1. ASTM C618-19 Class N or Class F materials (Class C is not permitted).

2. ASTM C989/C989M-18a Ground Granulated Blast Furnace Slag.
- D. Water: ASTM C1602/C1602M-22 Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.
- E. Concrete Aggregates: ASTM C33 / C33M-08 except as otherwise specified hereinafter. All aggregates shall be nonreactive and nondegenerative, and shall consist of sound crushed rock, washed gravel, or a combination of both.
1. Aggregate size for structural slabs shall be 1-1/2 inch. Aggregate size for other structural concrete shall be between 3/4 inch and 1-1/2-inch maximum.
 2. Aggregate shall be saturated surface dry by batch plant.
 3. Modify fine aggregates when air entrained concrete is used in accordance with Paragraph 4.2.4 of ASTM C33 / C33M-08.
 4. Aggregate shall result in shrinkage of concrete not exceeding .048 percent at 28 days. Testing lab shall verify aggregate and concrete shrinkage.
 5. Do not use fine or coarse aggregates that contain substances that are known to cause spalling or adverse reactions in the concrete.
- F. Cementitious Materials:
1. Fly Ash: 40 percent replacement maximum.
 2. Slag Cement: 50 percent maximum.
 3. Combined Fly Ash and Slag Cement: 50 percent replacement maximum.
- E. Air Entraining Agents shall be used in concrete at the contractor's option. The maximum entrained air content shall be no more than 4 percent + 1 percent by volume. Sika AER, Master Builders Micro Air, Darex AEA, Protex AEA or approved equal meeting ASTM C260/C260M.
- F. Admixtures: Except for air entraining agents, and water-reducing admixtures, no other admixtures shall be used without written approval from the Architect. Where such agents are permitted, they shall be a type approved and used only as directed by the Architect and at no increase in cost to the Owner.
1. Calcium chloride will not be permitted for use in concrete under any circumstances.
 2. Air Entraining Agents: ASTM C260. Use where specified. The maximum entrained air content shall be no more than 4 percent + 1 percent by volume unless noted otherwise. Approved air entraining agents are Sika AER, Master Builders Micro Air, Darex AEA, Protex AEA or approved equal.
 3. Water Reducing Admixtures: ASTM C494 Type A, D, E, F, or G and ACI 318, Section 3.6. Use where specified.
- 2.02 CRUSHED ROCK BASE:
- A. Under all new concrete ramps and paving, or as otherwise indicated on the Drawings, provide a minimum of 4 inches of crushed rock fill. Crushed rock fill shall be clean gravel of 1" max. size and have no material passing through a No. 4 sieve.
- 2.03 JOINT MATERIAL:

- A. Provide 3/8" wide fiber expansion joint material, Model No. 320-F, as manufactured by W.R. Meadows or approved equal.
- B. Provide Snap-Cap as manufactured by W.R. Meadows or approved equal. Snap-Cap shall have a top plastic edge that can be used for leveling concrete. Once concrete has set up, top edge of Snap-Cap can be pulled free and discarded. Joint shall then be sealed.
- C. Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be chosen by Architect from the full range of manufacturer's standard colors.

2.04 RELATED MATERIALS

- A. Concrete Adhesive and Bonding Agent: "Concresive #1001-LPL" (1-1/2-hour maximum pot life), an epoxy polysulfide type concrete adhesive as manufactured by Master Builders or approved equal.
- B. Liquid Curing Compound: W.R. Meadows, Product: "Vocomp-20" or approved equal.
- C. Bonding Adhesive: White Cap Glue, Burke Bondcrete-S or approved equal; use as a modifier for patching and overlays up to 1/2" thick or approved equal.
- D. Doweling Epoxy: Hilti "HIT-RE 500" (ICC-ES ESR-3814), Simpson Strong-Tie "SET-3G" Epoxy (ICC-ES ESR-4057) or approved equal.
 - 1. Anchor rods shall be furnished with a 45-degree chisel point on one end to allow for easy insertion into adhesive filled hole and manufactured to meet the requirements of ASTM A36. Nuts and washers shall be furnished to meet the requirements of the anchor rod specifications noted above.
 - 2. Install per manufacturer's recommendation; use stainless steel for all exterior work.
 - 3. Testing required as noted in the Structural Drawings.
- E. Vapor Barrier: Stego Wrap, 15 mil. vapor barrier system, with a Class A rating, and perm rating not to exceed 0.01 perms; by Stego Industries of San Juan Capistrano, CA (877) 464-7834, VaporGuard by Reef Industries (713) 507-4250., Sundance 15 mil Vapor Barrier by Sundance Inc. (855) 300-7156, or 15 mil Husky, Yellow Guard, Vapor Barrier by Poly-America (800) 527-3322. No other substitutions will be accepted. System to include Stego Mastic, Stego "Crete Claw Tape" and pipe boots, or approved equal by the specified manufacturers. Conform to ASTM 1745.
- F. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or approved equal.
- G. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed, non-metallic, no chlorides, non-staining, and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.

2.05 CONCRETE DESIGN

- A. The concrete mix shall be proportioned to produce a minimum ultimate compressive strength at 28 days of 4,000 psi for structural concrete and 3,000 psi for all other concrete (Section 32 16 00) unless otherwise noted.

1. Laboratory Mix Design: Concrete designs, using Methods B or C, Section 1905.1.1 of the CBC, Title 24, shall be reviewed by the Testing Laboratory. The concrete mix designs reviewed by the Testing Laboratory and approved by the Project Architect or Structural Engineer shall be used by the Contractor. Contractor shall provide samples of aggregates as required by the laboratory to review the mix designs. Laboratory shall also include shrinkage tests.
 2. Water Reducing Admixture: All concrete shall contain a water reducing admixture.
 3. Air Entraining Agent: Include in all concrete in all exterior concrete to result in concrete at point of placement having an air entrainment of 4% (+/- 1%).
 4. Maximum water - cement ratio at point of placement: 0.45.
- B. Ready-Mixed Concrete: ASTM C94 / C94M-09a except as otherwise specified herein.
1. Transit-mixed concrete shall be mixed for a period of not less than 10 minutes at a peripheral drum speed of approximately 200 feet per minute, and mixing shall be continued until discharge is complete. At least 3 minutes of the mixing period shall be at the job. Transit mixers shall be equipped with water measuring devices consisting of either accurately calibrated water tanks or water meters.
 2. When outside air temperature is between 85 degrees and 90 degrees, reduce mixing and delivery time from 90 minutes to 75 minutes. When outside air temperature is above 90 degrees, reduce mixing and delivery time to 60 minutes.
- C. Job Mixing: The capacity of the mixer shall be such that it will handle one or more full sack batches. No split sack batches will be permitted except when all materials are weighed. The rated capacity of the mixer shall not be exceeded. The mixing drum shall be equipped with an automatic timing and locking device and with an accurate water gauge for measuring the amount of water used. Mixing time of each batch shall be at least 1-1/2 minutes after all ingredients are in the mixer.
- D. Slump of Concrete: The slump of concrete as determined by the Standard Test Method for Slump of Hydraulic Cement Concrete ASTM Designation C-143 / C143M-09 shall be as follows:
1. All Concrete: 4 inches maximum, plus/minus 1 inch (5 inch maximum).

PART 3 – EXECUTION

3.01 CONCRETE PLACEMENT

- A. Surrounding Conditions: Before any concrete is placed, the following items of work shall have been completed in the area of placing.
1. Forms shall have been erected, braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
 - a. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
 2. Reinforcing steel shall have been placed, tied, supported, and, at time concrete is placed around it, shall be cleaned of rust, scale, mill scale or other coatings that will destroy or reduce bond.

3. Embedded work of all trades shall be in place in the forms, tied and braced.
 4. The entire place of deposit shall have been cleaned of dirt, chips, sawdust, rubbish, debris, hardened concrete, and other foreign matter before concrete is deposited therein. No wooden ties nor blocking shall be left in concrete except where indicated for attachment of other work.
 5. Concrete surfaces to which fresh concrete is to be bonded shall be roughened as indicated. Surfaces shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.
- B. Conveying Concrete from mixer to forms shall be as rapid as possible.
1. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94 / C94M-09a. A delivery ticket shall be furnished for each load of ready-mix or transit-mix concrete. A copy of each delivery ticket shall be handed to the job superintendent at the time of delivery and unloading. A record copy of the delivery tickets shall be forwarded to the Architect for their files.
 2. Conveying equipment shall be of a sufficient capacity to ensure a continuous flow of concrete to the placing point without separation or loss of materials. Carts and buggies shall be equipped with pneumatic tires. Runway supports shall not bear on reinforcing or fresh concrete. All conveying equipment shall be thoroughly cleaned before beginning and at frequent intervals during the placing of the concrete.
 - a. Chutes, if employed, shall slope not less than 4" or more than 6" per foot of horizontal run.
 3. Exercise care not to spill concrete on forms & reinforcing steel during the conveying operations. Where such spillage or splattering occurs, the surfaces shall be thoroughly cleaned before concrete hardens.
- C. Placing Concrete: Notify the Architect 48 hours in advance of beginning of pouring operations. Under no circumstances shall concrete that has partially hardened be deposited on the work. No concrete shall be placed during rainy weather without the Architect's approval.
1. The Project Inspector shall keep a record on the site of the time and date of placing the concrete in each portion of the structure in accordance with CBC Section 1705A.3.6. The record shall be kept until the completion of the structure and a copy provided to the Architect and DSA.
 2. Before starting new pour on or against concrete that has hardened, forms shall be retightened, and the hardened concrete roughened and thoroughly cleaned of foreign matter and any laitance by sandblasting. Just ahead of the new pour, slush joints with a 2" layer of grout of the designated concrete mix minus 50 percent of the large aggregate.
 3. Reinforcing steel exposed to the sun shall be cooled by a water spray prior to the placing of concrete.
 4. No adjustment of steel reinforcement will be permitted during the placement of concrete.
 5. Concrete shall be scheduled so that the placing is a continuous operation for the completion of each section between predetermined construction joints. If a planned concreting operation cannot be carried on continuously, the concreting shall stop at temporary bulkheads. Locate where resulting construction joints shall be as shown on the Drawings or as approved by the Architect. Prior to placing of concrete for any concrete slabs, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.

6. Deposit the concrete in forms as nearly as practicable in its final position to avoid flowing and maintain until completion of the unit an approximate horizontal plastic surface. Thoroughly compact all concrete during placing operations, thoroughly around reinforcement, embedded fixtures, or accessories, and into the corners of forms to eliminate air pockets and honeycombing. Compacting shall be done with mechanical vibrators. Vibrators shall not be used to cause concrete to flow horizontally. Thoroughly compact concrete to the forms to release the air and secure full contact of the concrete with the forms.
7. Hot Weather Concreting: Concrete placing and finishing operations during hot weather shall be done as quickly as possible. Ample personnel shall be available to manage and place the concrete immediately after its mixing or delivery to the site of the work. Concrete shall be placed in layers thin enough and over areas small enough to ensure complete bond and union of adjacent layers, and thus prevent "cold joints".
 - a. At air temperature of 80 degrees Fahrenheit or above, the following precautions should be taken:
 - 1) In no case shall the temperature of the concrete exceed 90 degrees Fahrenheit when placed in the work.
 - 2) If necessary, to produce and maintain concrete at an acceptable temperature, chopped or crushed ice shall be added directly into the mixer up to 50 percent by weight of the mixing water used, the weight of the ice being included in batch weight of the mixing water. The ice shall be added at such a rate and in such a manner that it will be completely melted by the time concrete is mixed.
 - 3) Stockpiled aggregates shall be saturated and kept surface moist by continuous fog spray or by intermittent sprinkling.
 - 4) Forms, reinforcements, and subgrade surfaces shall be wet down immediately before concrete is placed in contact therewith. Remove all excess water before placing concrete. Wetting down of areas around the work to cool the surrounding air and increase the humidity is recommended.
8. Cold Weather Requirements: Do not place concrete when ambient temperature is below 40 degrees Fahrenheit and falling.

3.02 CONCRETE FINISHING

- A. All Concrete Work, except as otherwise specified, shall be of a quality that will present a finished appearance upon the stripping of the forms. Only a minimum of patching and finishing should be necessary as required to fill holes left by form ties and to remove any fins or minor irregularities left by the joints in the forms. Except as otherwise specified, all concrete surfaces shall be finished as follows:
 - B. Float finish: Begin float finish when bleed water sheen has disappeared, and the 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 within a tolerance as specified in 3.04-C. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular surface.
 1. Final Finish: Provide a medium textured broom finish for all exterior surfaces by drawing a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

2. No magnesium bull floats allowed on non-air entrained concrete.
- C. Floor Flatness and Floor Level Tolerances:
1. An independent testing agency will inspect finished slabs for compliance with specified tolerances.
 2. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values at slabs on grade and shored slabs:
 - a. Exposed to View and Foot Traffic: F(F) of 35; F(L) of 25.
 - b. Under Thick-Bed Tile: F(F) of 20; F(L) of 15.
 - c. Under Carpeting: F(F) of 25; F(L) of 20.
 - d. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25.
 3. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 72 hours after slab installation; report both composite overall values and local values for each measured section.
 4. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
 5. Correct defects by grinding, floating with leveling compound, or by removal and replacement of the defective work. Areas requiring corrective work to be identified by Contractor and a repair/replacement plan shall be submitted for review by Architect. Re-measure corrected areas by the same process.
- D. Curb Finishing: Steel trowel as described for slab finishing above.
- E. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to a radius of 1/4". Repeat tooling of edges and joints after applying surface finishes. Eliminate tools marks on all concrete surfaces.
- F. Forms shall remain in place for not less than the following periods of time. These periods represent minimum cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
1. Vertical forms of foundations and walls: 5 days.
 2. Slab edge screens or forms: 2 days.
 3. Concrete columns and beam soffits: 28 days.

3.03 CONSTRUCTION JOINTS

- A. NO SOFTCUT (SAWCUT) CONTROL JOINTS ALLOWED.
- B. Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline unless otherwise indicated.
- C. Joints at Existing Concrete: All joints between existing concrete and new concrete or at sawcut locations through existing slabs are to include dowels at a minimum of #4 bars @ 4'-0" on center, 18" maximum from the ends, epoxy set into existing concrete a minimum of 6" in length at the centerline of existing concrete slab.

- D. Contraction Joints (Control Joints): Provide weakened-plane contraction joints, sectioning concrete into areas indicated. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness unless otherwise noted on drawings. Form in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool. **Joints to be spaced at 10' on center maximum or as shown on the drawings.**
- E. Construction Joints: Set construction joints at side and end terminations of concrete placement and at locations where placement operations are stopped for more than 1/2 hour unless placement ends at isolation joints.
 - 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys. Use Burke "Keyed Kold Joint Header Form" or approved equal. Embed keys at least 1 1/2" into concrete.
 - 2. Provide slip dowels across construction joints.
- F. Isolation Joints (Expansion Joints): Form isolation joints of performed joint filler strips abutting concrete curbs, catch basin, utility access holes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Extend joint fillers full width and depth of joint, not less than 1/2" or more than 1" below finished surface where a joint sealant is indicated. Place top of removable joint filler flush with finished concrete surface.
 - 2. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary, removable performed cap.
 - 3. After concrete has cured, remove cap exposing top edge of fiber joint filler, and apply joint sealant.

3.04 PUMPING OF CONCRETE (may be permitted for concrete, providing):

- A. The Contractor engages a testing laboratory to design concrete mixes for pumping. Trial batches shall be made and tested as required hereinbefore for typical concrete.
- B. The quality and proportioning of aggregates for pumping conditions shall be determined in accordance with ACI, Recommended Practice 613. Aggregate proportioning must be tailored to the pump intended for use.
- C. When starting a pump operation, actual pumping of concrete shall be preceded by a mortar mix (concrete without coarse aggregate) for the purpose of lubrication.
- D. All mortar and concrete leakage resulting from pumping operations shall be removed from formwork, reinforcing steel and any finished surface.

3.05 CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperature. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation control is to be implemented in hot, dry and windy weather by protecting concrete from rapid moisture loss before and during finishing operations with an evaporation control

- material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but not before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
 - D. Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination.
 - 1. For moisture-curing, keep surfaces continuously moist for not less than 7 days with water, a continuous water-fog spray, or absorptive cover kept wet continuously wet.
 - 2. For moisture-retaining-cover, cover concrete with moisture retaining cover with side and end laps sealed.
 - 3. For curing compound, apply in accordance with manufacturer's instructions. Recoat areas subjected to rainfall within 3-hours after initial application.

3.06 CLEANING AND PROTECTION

- A. Clean all surfaces and leave in satisfactory condition to receive final finish surface treatment.
- B. Protect concrete surfaces from damage by tools, equipment, material, and workers. No traffic, shoring or other loading will be permitted until concrete has hardened sufficiently to prevent injury to finish and strength, but at least 14 days.
 - 1. Remove surface stains and spillage of materials as they occur.
 - 2. Sweep concrete and wash free of stains, discolorations, dirt, and other foreign material prior to final inspection.

3.07 INSPECTION

- A. Approval of reinforcing steel, after installation, must be received from Project Inspector. Architect, Structural Engineer, and DSA must be notified 48 hours in advance of beginning concrete placement operations. Inspection of welding will be done by laboratory.
- B. There will be initial or preliminary inspection of the finished concrete slabs by the Project Inspector and/or Architect for overall finish.
- C. Slabs shall be measured for FF and FL as required by 3.02-C and findings submitted to Architect.
- D. New pours will be reviewed for cracks. If during this inspection, cracked sections are found and determined unacceptable by the District, that section should be removed and replaced.
- E. Final concrete inspection: Prior to occupancy, concrete will be reviewed by Owner and Architect. If any cracks, spalls, exposed finish layer separation, etc. are identified, that section(s) shall be removed and replaced.

END OF SECTION

SECTION 05 50 00

METAL FABRICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Shop fabricated ferrous metal items, galvanized and prime painted.
2. Schedule of metal fabrications.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. 09 91 00 - Painting.

1.02 REFERENCES

- A. ASTM A36 - Standard Specification for Carbon Structural Steel.
- B. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- C. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- F. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- G. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- I. AWS D1.1 - Structural Welding Code - Steel.
- J. SSPC - The Society for Protective Coatings.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Provide specific submittal for all ramp and sloped walk guide rails, handrails, and guardrails prior to fabrication clearly showing spacing of rails and embed details.
- C. Indicate welded connections using standard AWS A2.1 welding symbols. Indicate net weld lengths.

1.03 QUALITY ASSURANCE

- A. Welders' Certificates: Submit under provisions of Section 01 33 13, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- B. Field Measurements
 - 1. Verify that field measurements are as indicated on Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wide-flange Sections: ASTM A992, Grade 50.
- B. Steel Tubing: ASTM A500, Grade B.
- C. Steel Plates, Channels, Angles: ASTM A36.
- D. Pipe: ASTM A53, Grade B, Schedule 40.
- E. Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A 153 for galvanized components.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Shop and Touch Up Primer: SSPC 15, Type 1, red oxide.
- H. Touch-Up for Galvanized Surfaces: Zinc rich galvanizing paint. Must contain either between 65% to 69% metallic zinc by weight or greater than 92% metallic zinc by weight in dry film. "Brite" sheen required at exposed galvanized finish. Spray application not acceptable; brush applied only.

2.02 EQUIPMENT SUPPORT SYSTEM

- A. Provide galvanized Unistrut, or other approved.
 - 1. Main Runner: P5500 channel at 8-foot centers.
 - 2. 5/8-inch hanger rods at 48 inches on centers and hanger clamps.
 - 3. Cross Runner: P3000 channel at 4-foot centers.

4. P3047 "U" shaped fittings.
5. Provide and size pipe clamps as required.
6. Provide hardware and accessories as required.

2.03 FABRICATION

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

2.04 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with one coat.
- D. At surfaces scheduled to be galvanized: Galvanize assembled items to minimum 1.25 oz/sq ft zinc coating in accordance with ASTM A 123. Apply brush applied zinc-rich galvanizing paint over field welds and adjacent areas where hot dipped galvanizing has been damaged. "Brite" sheen required at exposed galvanized finishes.
- E. Repair damaged galvanized surfaces in accordance with ASTM A780 Method A2.
- F. Finish: Site paint exposed to view prime painted and galvanized items under provisions of Section 09 91 00.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. WELDING
 - 1. Except for modifications indicated on drawings and specified herein, AISC Code of Standard Practices for Steel Buildings, and AWS Code for Fusion Welding and Gas Cutting in Building Construction, both as amended to date, govern materials, fabrication and erection of work under this Section.
 - 2. Make welds in accordance with best standard practice. Perform welding on unexposed sides to prevent pitting, discoloring, weld-halo and other surface imperfections. Thoroughly clean surfaces to be welded. Welds must show a uniform section and reasonable smoothness without distortion. No exposed spot welding permitted. Dress and finish exposed surfaces of welded joints to produce invisible connections. Furnish welding alloys in the same color and character as the surfaces of the metals joined.

3.04 CONSTRUCTION

- A. Insofar as possible, fit and shop assemble work ready for erection. Accurately make jointing and intersections in true planes, and with adequate fastenings. Make exposed joints even and smooth. Grind exposed weld joints smooth and flush.
- B. Provide holes of proper size and in correct location for attachment of work of other trades. Cut, tape, and drill as required. Finished items must be free from kinks, twists, burrs and open joints. Damaged or distorted materials are not acceptable.

- C. Provide work to be built in concrete or masonry of proper form required for anchorage, or provide with concealed anchors.
- D. Form work true to detail, with clean, straight and sharply defined profiles. Close fit exposed joints and make where least conspicuous.
- E. Install supporting members, fastenings, frames, hangers, bracing, brackets, bolts, angles, and the like as required to set and connect items of miscellaneous metal to concrete, steel or wood framing.
- F. Countersink holes for exposed screwheads. Provide necessary lugs, brackets, and clips so work can be assembled and installed in a neat and suitable manner.
- G. Conceal fastenings where possible. Unless otherwise indicated, provide flathead or countersunk oval bolts and screwheads as best suited for the purpose.
- H. Weld in place plates for mounting item(s) of finish hardware.
- I. Provide bolts, anchors, inserts, and other miscellaneous steel and iron fastenings in forms before concrete is poured; or as to be built into masonry, as indicated on drawings, details or schedules, or as necessary to complete the work. Examine and check the Architectural, Structural, Mechanical and Electrical Drawings for number, type and locations of each item.
- J. MISCELLANEOUS ITEMS
 - 1. Furnish, fabrication, and install miscellaneous angles, channels, bent plate, clips, anchors, and other miscellaneous metal work required and as indicated on drawings. Form as detailed or if not detailed, as required for location and purposes served, and in accordance with the applicable provisions specified herein. Furnish and install miscellaneous metal items not specifically mentioned herein, or in other sections, but which are customarily considered as part of the work, the same as if fully specified herein and detailed on drawings.
 - 2. Furnish and install light steel structural items not noted on Structural Drawings or called for under "Structural Steel" section but which are shown on the other drawings.
 - 3. Furnish and install sleeves through masonry or concrete walls and footings. Fabrication of standard weight steel section of size sufficient to allow $\frac{1}{4}$ inch clearance between the sleeve and item to be inserted.
 - 4. Furnish and install anchors, brackets, and plates or suitable steel where required in connection with steel, masonry, wood and concrete construction.
 - 5. Fabricate steel channel and angle frames for doors, duct openings, scuttles, mechanical equipment, louvers, and other frames as shown and detailed to exact size required and in accordance with approved shop drawing. Neatly join corners, weld and grind smooth. For securing to concrete or masonry, weld concealed anchors on the back. Secure bar stops to frames with countersunk flathead screws or plug weld from the back. Prepare steel frames to receive necessary hardware. Where mechanical equipment such as fans, blowers, etc., and sheet metal are shown or specified to be attached in steel frames, the drilling, tapping and attachment must be done by trade involved.

6. Furnish corner guards, bumpers, etc., of sizes and shapes indicated and with anchors welded to the backs and of sizes and spacing shown.
7. Provide hot-dipped galvanized steel and iron for exterior use.

K. FINISH

1. Except where indicated, or specified to be galvanized, clean miscellaneous steel and iron of any grease, rust, mill scale, or other foreign matter, and give one shop coat of the specified primer: Do not prime material to be embedded in concrete.
2. After welding is completed, repair damage to the galvanizing by applying a minimum of two coats of liquid galvanizing compound in accordance with manufacturer's instructions to provide a coating equal to original finish.

3.05 SCHEDULE

- A. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Miscellaneous Framing and Supports: Steel not a part of structural steel framework as required to complete work; galvanized prime paint finish.
- C. Joist Hangers: Joist strap anchors, galvanized prime paint finish.
- D. Ledge and Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of metal decking, joists, masonry, galvanized, and prime paint finish.
- E. Lintels: As detailed; galvanized prime paint finish.
- F. Metal Gates and Fences: Welded tubular steel as detailed, complete with all necessary hardware; hot-dipped galvanized, primed with paint finish.
- G. Steel pipe railing: hot-dipped galvanized at exterior, primed and painted at interior.
- H. Pipe rail wall support brackets: hot-dipped galvanized at exterior, primed and painted at interior.
- I. Steel pipe downspouts and downspout support brackets: hot-dipped galvanized and painted.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Description of requirements for materials, fabrications and installation of rough carpentry and associated items (except that which is specified elsewhere) indicated on Drawings and necessary to complete the work. Items include, but are not necessarily limited to, the following:
 - a. Blocking, Backing, Stripping, Furring, and Nailers.
 - b. Rough Hardware.
 - c. Wood Framing.
 - d. Plywood Sheathing.
 - e. Preservative Treatment.
 - f. Metal Fabrications.

B. Related Sections

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 03 30 00: Cast-in-Place Concrete.

C. References

1. Chapter 23, California Building Code (CBC), 2022, as adopted by the California Division of the State Architect (DSA).
2. American Society for Testing and Materials (ASTM).
3. Lumber: West Coast Lumber Inspection Bureau (WCLIB), Rule 17, Standard Grading Rules for West Coast Lumber.
4. Lumber: Western Wood Products Association (WWPA); Western Lumber Grading Rules.
5. Plywood: American Plywood Association (APA) Plywood Specifications and Grades and Voluntary Product Standard DOC PS 1 "Construction and Industrial Plywood".
6. Wood Preservative: American Wood Protection Association (AWPA), Standard U1.
7. AF&PA NDS – National Design Specification for Wood Construction.
8. AF&PA SDPWS – Special Design Provisions for Wind and Seismic.

1.02 QUALITY ASSURANCE

- A. Manufacturer data: Submit product data for all materials specified under this section and as applicable to each site.
- B. Coordinate the work of all trades to ensure proper placement of all materials, anchors, etc., as well as providing for openings and anchors for the installation of surface mounted materials and equipment.
- C. Qualifications of Workmen: Provide sufficient skilled workmen and supervisors who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of construction involved and the materials and techniques specified.
- D. Rejection: In the acceptance or rejection of rough carpentry, no allowance will be made for lack of skill on the part of the workmen.
- E. Design Criteria: Pressure treatment shall not adversely affect application, permanence, or appearance of finish paint system.

1.03 SUBMITTALS

- A. Submit per the requirements of the General Conditions.
- B. Certification:
 - 1. Pressure Treated Wood: Certification for water-borne preservative that moisture content was reduced to 19% maximum, after treatment.
 - 2. Pressure Treated Wood: Submit certification by treating plant stating the chemicals and process used, net amount of salts retained, and conformance with applicable standards.

1.04 JOB CONDITIONS

- A. Environmental Requirements: Maintain uniform moisture content of lumber at 19 percent or less prior to close-in.
- B. Sequencing: Coordinate details with other work supporting, adjoining, or fastening to rough carpentry work.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protection, General: Protect wood from moisture while being stored and while work is in progress.
- B. Protection:
 - 1. After delivery, store all materials in such a manner as to ensure proper ventilation and drainage and to protect against damage and the weather.

2. Keep all material clearly identified with all grade marks legible; keep all damaged material clearly identified as damaged, and separately store to prevent its inadvertent use. Do not allow installation of damaged or otherwise non-complying material.
 3. Use all means necessary to protect the installed work and materials of all other trades.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Wood:

1. Lumber (Blocking, Backing, Stripping, Furring, and Nailers): WCLIB Construction.
2. Lumber (Wood Framing): Meet requirements of following minimum grades, and as noted on Structural Drawings.

Item	Species	Grade	Reference
Studs	D.F.	No. 1 2 x 4 Light Framing	WCLIB 124b
Studs	D.F.	No. 1	WCLIB 121
Plates	D.F.	No. 1	WCLIB 123b
Beams	D.F.	Select Structural	WCLIB 130b
Joists	D.F.	No. 1	WCLIB 123b
Posts	D.F.	Select Structural	WCLIB 131b

3. 3x and larger lumber shall be free of heart center.
4. 2x6 T & G Douglas Fir No. 1.

B. Plywood:

1. Roof and Wall Structural Sheathing: PS-1 Structural 1, CDX APA with exterior glue.
2. Thickness and type shall be as indicated on Drawings.

C. Pressure-Treated Lumber:

1. Douglas Fir, pressure treated.
 - a. Required for cast-in-nailers, sills or anywhere wood is in contact with concrete, masonry, or grout.
 - b. Required for all rooftop blocking.

D. Building Paper: Fed. Spec. UU-B-790a, Type I, Grade B (15 lb. min.).

E. Preservative Treatment

1. Furnish pressure treated Douglas Fir in accordance with AWPA, Standard U1. Each piece is required to bear AWPA stamp.
 2. Field treat cut edges and holes drilled in factory treated lumber with an approved AWPA Standard U1 preservative product.
 3. For fastener requirements, see Paragraph 2.01-F-8.
- F. Rough Hardware Fastenings and Connections: All types including bolts, lag screws, nails, spikes, screws, washers, framing devices and other rough hardware, or kinds that may be purchased and that require no further fabrication, shall be furnished, and installed for all finish and rough carpentry. All exterior hardware shall be hot-dipped galvanized per ASTM A123 / A123M-09 Standards.
1. Nails: ASTM F1667 Common wire nails or spikes; box nails not permitted.
 2. Wood Screws: Wood Screws: ANSI Standard B18.6.1; use galvanized type for exterior work.
 3. Lag Screws: Conform to ASTM A307-07b and ANSI Standard B18.2.1. Dimensions and installation shall conform to requirements described in the National Design Specification (NDS), current edition.
 4. Bolts: ASTM A307-07b, Grade A, hexagonal heads, unless noted otherwise.
 5. Washers: Washers for bearing against wood shall be provided under all bolt heads and nuts. Washers shall be as indicated on Drawings.
 6. Powder Driven Fasteners: Tempered steel pins with special corrosive-resistant plating or coating. Pins shall have guide washers to accurately control penetration, minimum 1-1/8 inch. Fastening shall be accomplished by low-velocity pistol-driven powder activated tool. Pins and tool shall be as manufactured by Hilti Fastening Systems; Impex Tool Corporation; or approved equal. ICBO approved.
 7. Fabricated Sheet Metal Timber Framing Connectors: CBC approved. Fabricate from hot-dipped galvanized steel. Connectors shall be at least 18 gauge minimum material (1/8" plate materials where welded, unless otherwise noted), punched for nailing. Nails and Nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Types as noted on Drawings, manufactured by Simpson Co. or approved substitute. All framing connectors shall be stamped with manufacturer's logo, and model designation.
 8. All fasteners into preservative-treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper per CBC 2304.10.5. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of zinc coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.
- G. Exterior Trim and Fascia: RIS Grade Stamped, Redwood, B Heart, Vertical Grain, Kiln Dried, surfaced sizes as indicated on the drawings.

2.02 FABRICATION

A. Lumber:

1. Air- or kiln-dry to maximum 19 percent moisture content, prior to installation. Lumber must be 19 percent moisture content prior to close-in and finish.
2. Furnish S4S unless otherwise noted.

3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.

2.03 SOURCE QUALITY CONTROL

- A. Grade Mark each piece of lumber. Marking must be done by recognized agency. Lumber Manufacturer's Association Certificates may be accepted in lieu of such grade and trademarks.
 1. Douglas Fir shall bear WCLIB grade stamp.
- B. Plywood Sheathing: Each panel shall be legibly identified as to type, grade, and specie by APA grade. If plies are spliced, the slope of the scarf shall not be steeper than 1:8. White pockets will not be permitted in face plies.
- C. Each piece of preservative treated lumber shall bear AWPA stamp.

2.04 WOOD PRESERVATIVE TREATMENT

- A. Preservative treatment: Comply with applicable requirements of AWPA standards C2 for lumber and C9 for plywood. After treatment, kiln dry lumber to a maximum moisture content of 19 percent, and plywood to 15 percent.
 1. Pressure treat members connected with roofing, flashing and weatherproofing; including but not limited to cants, nailers, curbs, equipment supports and blocking.
 2. Pressure treat members that are concealed and in contact with masonry or concrete, including, but not limited to, sills, nailers, blocking, furring and studs.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

- A. 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 installation may properly proceed.
 2. Verify that rough carpentry may be performed in strict accordance with the original design and all pertinent codes and regulations.
- B. Selection of Lumber Pieces: Carefully select all members. Select individual pieces so that knot and obvious defects will not interfere with placing bolts or proper nailing or making proper connections. Cut out and discard all defects which will render a piece unable to serve its intended function.
- C. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting. No load carrying member shall be exposed to earthen materials.

D. Shimming: Do not shim any framing component.

3.02 FASTENING

A. Nailing: Except as otherwise indicated on Drawings or specified, all nailing shall be as scheduled on Drawings:

1. Nails or Spikes shall be common wire unless noted otherwise. Penetration of nails or spikes shall be one-half the length of the nail or spike into the piece receiving the point. However, to connect pieces 2 inches in thickness, 16d nails shall be used unless noted otherwise.
 - a. Bore holes for nails wherever necessary to prevent splitting.
 - b. Use finish or casing nails for finish work.
 - c. Use of nailing guns is as limited by CBC and must be approved by Architect and DSA. Submittal of guns and nails is required.

B. Bolts: Bolts shall be of sizes indicated. Drive fit with washers under nuts. Tighten all bolts and screws before closing in.

C. Framing Devices: As specified under Products, sizes as indicated. Use half-length nails where required.

D. Lag Screws: Pre-Bore lead holes and install per NDS, current edition.

3.03 FRAMING AND ROUGH CARPENTRY

A. Sills: Shall be in long lengths of sizes shown, fastened with anchor bolts at exterior walls and with powder driven fasteners at interior walls as indicated, a minimum of two (2) fasteners per piece and a bolt within 9" but not nearer than 6" from end of piece. Place malleable iron or steel plate washers (but not cut washers) under nuts bearing on wood. Set sills level and true and bed exterior wall sills and interior bearing wall sills on 1/2 inch dry-pack or non-shrink grout.

B. Studs, Posts and Columns: Shall be full length. Corners shall be as detailed. Partitions or walls containing plumbing, heating or other piping shall be so formed as to give proper clearance for materials. Cut members as required to provide full bearing at ends. Connect to structure as indicated.

C. Plates: Shall be in long lengths and spliced as shown.

D. Blocking: Shall be same thickness and width of studs or joists unless shown otherwise. Blocking shall not be spaced over 8'-0" o.c. Install fire blocking in accordance with CBC, Section 717. Install blocking at all plywood joints unless otherwise noted on the drawings. Install blocking for fastening all surface applied items.

E. Joists and Beams: Shall be in long lengths and spliced over bearings unless shown otherwise. Install with crown side up. Beams or headers indicated to be built up of two or more joists shall be fabricated on the job using full length members. For two-piece members, stitch nail pieces together

- with 16d common nails spaced not over 12" o.c. and staggered. Clinch nails protruding through members.
1. Provide double joists and headers at all openings through floors and roofs unless otherwise shown on Drawings.
 2. Provide typical headers at all openings through walls where one or more studs are required to be cut. For penetration through walls narrower than stud spacing, provide solid backing on all sides for fastening finish materials.
- F. Plywood Structural Sheathing: Install to pattern indicated and provide blocking at joints where noted on the drawings. Center all joints overbearing supports. Nail to framing as indicated. Install plywood with face plies perpendicular to joists or studs unless indicated otherwise.
- G. Wood Furring, Stripping and Grounds: Install as shown or required to provide nailing of materials or passage of pipes, conduits, etc., not otherwise accommodated.
- H. Bridging: Space not over 8'-0" o.c. for spans over 16'-0". Spans over 8'-0" and under 16'-0" shall have bridging placed at midspan. Bridging shall be two 2 x 3's or solid blocking as indicated. Joists 8" or less in depth shall not require bridging unless specifically indicated.
- I. Backing: Shall be provided for all wall and ceiling finishes and for supporting of fixtures and equipment for all trades, including toilet partitions, toilet room accessories, frames, case work, mirrors, trim, applied wall finishes, etc. Coordinate placement of backing and supports with manufacturer or supplier of mounted items.
- J. Building Paper: Install two layers in all exterior locations. Install with weather lap edges a minimum of 2 inch horizontal and 6-inch vertical laps. Continue building paper minimum 6 inches around inside and outside corners. Fasten in place with appropriate staples.
- K. Cuts or holes in preservative treated wood shall be treated in accordance with AWPB standard M4 in the field.

3.04 MISCELLANEOUS HARDWARE

- A. Finish hardware is specified in Section 08 71 00. All other hardware indicated or required but not specified elsewhere shall be furnished and installed hereunder, including appropriate screws or other fastening devices.

3.05 MISCELLANEOUS CARPENTRY WORK

- A. Miscellaneous Carpentry Work not included under other sections shall be furnished and installed hereunder as indicated. Carefully locate and securely anchor such items to structure.
- B. Drypack: Drypack shall consist of 1 part high early strength Portland cement to not more than 3 parts of sand by volume. Add only a minimum amount of water to hold the mixture in shape while packing and to provide hydration. Solidly ram drypack into place to provide uniform bearing and cure with moist sacks or cloths for a period of at least three (3) days.

- C. Plywood Backing for electrical, telephone, and similar types of wall mounted equipment shall be provided hereunder where required. Plywood shall be 3/4" thick exterior A-C plywood with 'A' face exposed.
- D. Shoring and Bracing: Shore or brace for temporary support of all work as required during the construction period except any shoring and bracing specified and included under other sections of these specifications.
- E. Temporary Enclosures: Provide and maintain all barricades and enclosures required to protect the work in progress.
- F. Protect all work in progress and all work installed, as well as the work of all other trades. Any work damaged as a result of the work under this section shall be corrected to its original condition or replaced if directed by the Architect and at no increase in cost to the Owner.
- G. Protection Devices: Pedestrian walkways, barricades, lights, shoring and other protective structures and devices necessary for the protection of pedestrians shall conform in all respects to the requirements of CBC, Section 3303, Title 24 and to the requirements of the Department of Public Works.

3.06 FRAMING TOLERANCES

- A. Maximum variation from true flatness: 1/4 inch in ten feet in any direction.

3.07 CLEAN-UP

- A. Upon completion of the work of this Section, remove all surplus materials, rubbish, and debris from the premises.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL CASEWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Special fabricated cabinet units.
2. Countertops.
3. Preparation for utilities.
4. Cabinet hardware.

B. Related Sections:

1. A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. 06 10 00 - Rough Carpentry.
3. 09 65 00 - Resilient Flooring.
4. 09 65 16 - Resilient Flooring.
5. 09 68 13 - Carpeting.

1.02 REFERENCES

- A. North American Architectural Woodwork Standards (NAAWS).
- B. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- C. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- D. ASTM C615 - Standard Specification for Granite Dimension Stone.
- E. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.

1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Include materials, component profiles, fastening methods, assembly methods, joint details, accessory listings, and schedule of finishes. Provide WI Certified Compliance label on first page of each set. Shop drawings will be rejected until reviewed by the assigned Woodwork Institute inspector and label has been issued.

- C. Product Data: Manufacture literature for all hardware to be provided.
- D. Samples:
 - 1. Finishes for color selection.
 - 2. Hardware: drawer pulls, hinges, locks and other hardware accessories.
 - 3. Identification tag and fasteners.
 - 4. Submit two physical samples and product data sheets of drawer pulls, hinges, locks, ID tags, and other specified hardware accessories, illustrating hardware type and finish.

1.04 QUALITY ASSURANCE

- A. Manufacture casework items in accordance with quality standards of the NAAWS.
- B. All millwork and the installation of millwork shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- C. Provide WI Inspection Service at the millwork fabricator. Provide to Architect a written report showing the results of the inspection.
- D. Issue WI Certified Compliance Certificate to Architect prior to delivery of millwork and provide WI Certified Compliance Labels on all items of casework and countertops.
- E. Provide WI Reinspection Service at the job site prior to installation. Provide to Architect a written report showing the results of the reinspection.
- F. Self-Certification by the millwork fabricator or inspection by other than an authorized representative of The Woodwork Institute is not acceptable.
- G. Upon completion of the installation, provide a WI Certified Compliance Certificate.
- H. Regulatory Requirements
 - 1. Conform to CBC requirements for flame spread classification.
 - 2. Conform to Flame Spread Classifications of Interior Millwork contained within the Appendix of the NAAWS for flame spread ratings as tested according to ASTM E84.
- I. Mockup
 - 1. Prepare mockup under provisions of Section 01 33 00.
 - 2. Provide full size base cabinet and upper cabinet of each type indicated, in specified finish with hardware installed.
 - 3. Units will be examined to ascertain quality and conformity to NAAWS.

4. Units will establish a minimum standard of quality for this work.
5. Approved units may be used as part of the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage, and deter their erection from damage of any character. Work damages through neglect or failure to provide protection shall be made good by the contractor and without additional cost to the Owner.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.
- B. Field verify existing finish floor conditions to ensure specified finish countertop heights and knee space clearances at accessible stations are maintained. If shimming is required to level units, this shall be taken into account in base cabinet construction.

1.07 COORDINATION

- A. Coordinate the work with electrical rough-in, to assure orderly and efficient sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. See schedule of manufacturers, patterns, and colors.
- B. Active member of the Woodwork Institute licensed by WI to provide WI Certified Compliance Certificates and Labels for the products and materials specified in this section www.woodworkinstitute.com.
- C. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIALS

- A. Individual cabinets are indicated on the drawings by the NAAWS Appendix Cabinet Design Series (CDS) numbering system.
- B. Wood materials shall be Forest Stewardship Council (FSC) certified.
- C. Composite wood shall be free of added urea formaldehyde.
- D. Modular Casework - Laminated Plastic Covered
 1. Fabricate in accordance with Section 10 of the NAAWS:

- a. NAAWS Grade: Custom
- b. Type: Type 1
- c. Construction: Style A-Frameless
- d. Joinery: Frameless
- e. Cabinet Backs: Dadoed (Detail 2C and 78 of Millwork Man.) Type A. Type B for glass
- f. Cabinet Door Type: Type A. Type B for glass
- g. Shelves:
 - All shelving less than 25" to be 3/4-inch-thick melamine covered Industrial Board.
 - All shelves between 25" to 34" to be 1" inch thick melamine covered Industrial Board.
 - All shelves between 34" to 46" to be 3/4" inch thick HPL covered Veneer Core DF Plywood.
 - All shelves over 46" to be 1" inch thick HPL covered Veneer Core DF Plywood.
- h. Shelf Edge Bands:
 - 1mm PVC in color to match shelf at three concealed sides. 3mm PVC at exposed leading edge.
- i. Door and Drawer Edge Bands:
 - 3 mm PVC radiused 1/8 inch at edge. Solid color as selected by Architect.
- j. Exposed Surfaces (including shelves and interior of open front cabinets):
 - .045-inch thick high pressure plastic laminate.
- k. Semi-Exposed Surfaces (behind doors and inside drawers):
 - Low pressure decorative polyester or melamine laminate ALA-85.
- l. Security and Dust Panels: Particle board, 3/4 inch thick at all lockable drawers.

E. Countertops - Laminated Plastic

- 1. Fabricate in accordance with Section 11 of the NAAWS:
 - a. NAAWS Grade: Premium
 - b. Core Thickness: .075 inch minimum
 - c. Laminate Thickness: 1.50 inch or .042 inch for postformed use
 - d. Edge Covering: --
 - e. Backsplash: Square butt
 - f. Top of Back Splash: Square self-edge
 - g. Colors and Pattern: To be selected by Designer

G. Hardware

- 1. Finish: Satin Aluminum.
- 2. Shelf Standards: Knape and Vogt 255ZC (bright zinc plated).
- 3. Shelf Supports: Knape and Vogt 256ZC (bright zinc plated).
- 4. Shelf Fastener Supports: Knape and Vogt 243ZC (bright zinc plated) 2 each shelf.
- 5. Shelf Supports: Hettich "Sekura" or approved equal all metal construction with 80 lb load rating. Retention pins only required at front shelf support clips. Rear clips may be non-retention pin type. Clips set in drilled holes spaced 32 mm on center.
- 6. Drawer and Door Pulls: 5 inch Epco 'U-shaped' wire pulls, Hafele, or approved equal. Pulls shall comply with CCR Section 11178.6(4) and 11258.4.
- 7. Cabinet Locks: National Lock C8123, Corbin 0737, K and V 986, or equal. Install on all cases unless otherwise noted.
- 8. Drawer Slides for Drawers 24 inch Wide or Less: Accuride 7432.
- 9. Drawer Slides for Drawers over 24 inch wide: Accuride 3640.

10. Drawer slides for File Drawers: Grant No. 329 heavy duty ball bearing full extension slides with 100 lbs. capacity at large flat file drawers use Accuride No. 3640, 200 lbs., full extension, ball bearing, rail mount slides.
11. Hinges: Rockford Process Control, No. 851, heavy duty wrap-around, tight pin butts of steel, 2-3/4-inch minimum width with companion magnetic door catch capable of a minimum 10-pound pull capacity. Hinges per leaf: 3 feet 0-inch-high doors – two (2) hinges, 3 feet 0 inch to 5 feet 0-inch-high doors – three (3) hinges, 5 feet 0 inch to 7 feet 4-inch-high doors – four (4) hinges, 7 feet 0 inch to 8 feet 0 inch – five (5) hinges.
12. Magnetic Door Catch: Ives 326, or Hafele 246.43 .758.
13. Sliding Door Track Assemblies: Grant 2023N sheaves and Grant 2011 track.
14. Grommets: Hafele No. 429.99.128, 3-inch diameter or as noted on drawings.
15. Seismic Shelf Lip: 1/4 inch thick by 3-inch-high acrylic plastic or PVC edging of color selected by Architect. Ease all edges of plastic.
16. Remainder of hardware required shall be as listed in the Hardware Supplement to Sections 14 and 15 of the Manual of Millwork.
17. Substitutions: Under the provisions of Section 01 25 13.

2.08 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- C. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.
- D. Provide all supports and required inserts for laboratory type sink units.
- E. Install plastic grommets in the field in plastic laminate casework and Owner furnished furniture as directed by the Owner's Representative and/or Architect.
- F. Install seismic shelf lips on all exposed edges of open laboratory shelving with flathead countersunk wood screws spaced 6 inches on center. Finish exposed screw heads to match color of shelf lip.
- G. Install one (1) adjustable shelf for each 1 foot 0 inch of height for all wall mounted cabinets.
- H. Provide stretcher at top face of all door and drawer fronts.
- I. Provide locks on all doors and drawers.

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Set and secure casework in place rigid, plumb, and level.

B. Install casework in accordance with Section 10 and the Appendix of the NAAWS.

3.03 ADJUSTING AND CLEANING

A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.

B. Clean casework, counters, shelves, hardware, fittings and fixtures.

3.04 SCHEDULE

FINISH INDICATOR	MANUFACTURER	PATTERN	COLOR	REF #	FINISH	LOCATION
PL-1	X	-	X	X	X	X
PL-2	X	-	X	X	X	X

END OF SECTION

SECTION 07 01 50.72
REHABILITATION OF BUILT-UP ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Roof rehabilitation and coating preparation.
 - 2. Application of coatings on built-up asphalt roofing.

1.2 MATERIALS OWNERSHIP

- A. Demolished materials shall become Contractor's property and shall be removed from Project site.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.
- B. Existing Roofing System: Built-up asphalt roofing, and components and accessories between deck and roofing membrane.
- C. Roofing Coating Preparation: Existing roofing that is to remain and be prepared to accept restorative coating application.
- D. Existing to Remain: Existing items of construction that are not indicated to be removed.
- E. Manufacturer: Manufacturer of roofing rehabilitation products, unless otherwise indicated.

1.4 ROOFING CONFERENCES

- A. Roofing Rehabilitation Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system.
 - 1. Meet with Owner; Architect; roofing re-coating materials manufacturer's representative; roofing re-coating Installer including project manager and foreman; and installers whose work interfaces with or affects re-coating including installers of roof accessories and roof-mounted equipment requiring removal and replacement as part of the Work.
 - 2. Review methods and procedures related to re-coating preparation, including rehabilitation roofing system manufacturer's written instructions.
 - 3. Review drawings and specifications.
 - 4. Procedures for salvaging and recycling of demolition and construction waste
 - 5. Review temporary protection requirements for existing roofing system that is to remain, during and after installation.

6. Review roof drainage during each stage of coating application and review roof drain plugging and plug removal procedures.
7. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
8. Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect coating.
9. Review HVAC shutdown and sealing of air intakes.
10. Review shutdown of fire-suppression, -protection, and -alarm and -detection systems.
11. Review governing regulations and requirements for insurance and certificates if applicable.
12. Review procedures for asbestos removal or unexpected discovery of asbestos-containing materials.
13. Review existing conditions that may require notification of Owner before proceeding.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product specified.

1.6 INFORMATIONAL SUBMITTALS

- A. 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.
- B. 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 that proposed system components are compatible.
- C. Manufacturer's Certificate: Provide manufacturer's UL listing certificate for roofing system.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.
- B. Warranties: Executed copies of approved warranty forms.

1.8 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: Primary product manufacturer that is UL listed for roofing system identical to that used for this Project with minimum five years' experience in manufacture of

comparable products in successful use in similar applications, and able to furnish warranty with provisions matching specified requirements.

- 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 the following:
1. An authorized full-time technical employee of the manufacturer.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with rehabilitation 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 recommended by manufacturer.
 2. Apply coatings within range of ambient and substrate temperatures recommended by manufacturer.
 3. Do not apply roofing in snow, rain, fog, or mist.
- B. Protect building to be rehabilitated, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from rehabilitation operations.
- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- D. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
- E. Owner will occupy portions of building immediately below re-coating area. Conduct re-coating so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

1.10 WARRANTY

- A. Manufacturer's Warranty: Roof System Manufacturer's standard form in which Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within warranty period, as follows.
1. Form of Warranty: Manufacturer's standard warranty form.
 2. Scope of Warranty: Work of this Section and including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.
 3. Warranty Period: 10 year Material Only.
- B. Manufacturer Inspection Services: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's inspections is included in the Contract Sum.
1. Inspections to occur in following years: 2, 5 and 10 following completion.

- C. Installer Warranty: Installer's warranty signed by Installer, as follows.
 - 1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.
 - 2. Scope of Warranty: Work of this Section.
 - 3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer/Product:

- 1. Tremco, Inc. (specified)
- 2. Or approved equal.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Rehabilitated roofing shall withstand exposure to weather without failure or leaks due to defective manufacture or installation.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
- 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. Exterior Fire-Test Exposure: Roofing system exterior fire-test exposure performance following application of rehabilitation coating shall be not be less than that of the pre-rehabilitated roof performance when tested in accordance with ASTM E108, based upon manufacturer's tests of identical applications.
- D. Energy Performance: Provide roof coating with initial solar reflectance index not less than 78 when calculated according to ASTM E1980, based upon testing of identical products by a qualified testing agency.

2.3 MATERIALS, GENERAL

- A. General: Roof rehabilitation coating materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system.

2.4 ACRYLIC TOP COATINGS

- A. Acrylic Roof Coating, Highly-Reflective Elastomeric: high-solids acrylic latex elastomeric roof coating formulated for use on bituminous roof surfaces; water-based, Energy Star qualified, CRRR listed and California Title 24 Energy Code compliant.
 - 1. Basis of design product: Tremco, ICE Coating.
 - 2. Volatile Organic Compounds (VOC), ASTM D3960: 39 g/L.
 - 3. Emissivity, minimum, ASTM C1370: 0.83.
 - 4. Solar Reflectance Index (SRI), ASTM E1980: 103 (initial) 75 (3 year aged).
 - 5. Reflectance, minimum, ASTM C1549: 84 percent.

6. Solids, by volume, ASTM D5201: 65 percent.
 7. Minimum Thickness: 45 mils (1.1 mm) dry film thickness .
- B. Primer for Acrylic Coatings: Acrylic polymer primer to promote adhesion of acrylic emulsion coatings on single-ply membranes.
1. Basis of design product: Tremco, Tremco SP Primer.
 2. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 80 g/L.
 3. Solids, by Volume, ASTM D5201: 30 percent.
 4. Color: White dries clear.
 5. Nonvolatile content ASTM D1644: 32 percent (by weight).

2.5 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with existing roofing system.
- B. Seam Sealer: Waterproof seam and patching material compatible with applied coating.
1. Seam Sealer and Patching Sealer: Acrylic elastomeric sealer, single-component, high solids, low-VOC, formulated for compatibility and use with specified roofing and wall substrates.
 - a. Basis of design product: Tremco, SOLARGARD Acrylic Sealer.
 - b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 50 g/L.
 - c. Tensile Strength, minimum, ASTM D412: 450 psi (3100 kPa).
 - d. Hardness, Shore A: 45.
 - e. Elongation, minimum, ASTM D412: 300 percent.
 - f. Impact Resistance, minimum: 160 in/lb (18 kN/m).
- C. Reinforcing Fabric:
1. Polyester Reinforcing Fabric: 100 percent stitch-bonded mildew-resistant polyester fabric intended for reinforcement of compatible fluid-applied membranes and flashings.
 - a. Basis of design product: Tremco, Permafab.
 - b. Tensile Strength, Minimum, ASTM D5034 (2-inch): MD - 110 lbs (49.8 kg); XMD - 60 lbs (27.2 kg) avg.
 - c. Elongation, Minimum, ASTM D5034 (1-inch): MD - 25 percent; XMD - 100 percent.
 - d. Tear Strength, Minimum, ASTM D5587: MD - 20 lbs (9.0 kg) avg; XMD - 20 lbs (9.0 kg) avg.
 - e. Weight: 3 oz./sq. yd (102 g/sq. m).
- D. Joint Sealant: Elastomeric joint sealant recommended in writing by joint sealant manufacturer as compatible with applied coating and project substrates, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.
 - a. Basis of design product: Tremco, TremSEAL Pro.
 - b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.
 - c. Hardness, Shore A, ASTM C661: 40.
 - d. Adhesion to Concrete, ASTM C794: 35 pli.
 - e. Tensile Strength, ASTM D412: 350 psi (2410 kPa).
 - f. Color: White.
- E. Metal Flashing Sheet: Provide metal flashing sheet matching type, thickness, finish, and profile of existing metal flashing and trim.
- F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect existing roofing system that is indicated not to be rehabilitated, and adjacent portions of building and building equipment.
 1. Mask surfaces to be protected. Seal joints subject to infiltration by coating materials.
 2. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
 3. Maintain temporary protection and leave in place until replacement roofing has been completed.
- B. Pollution Control: Comply with environmental regulations of authorities having jurisdiction. Limit spread of dust and debris.
 1. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 2. Remove debris from building roof by chute, hoist, or other device that will convey debris to grade
- C. Shut down air intake equipment in the vicinity of the Work in coordination with the Owner. Cover air intake louvers before proceeding with re-coating work that could affect indoor air quality or activate smoke detectors in the ductwork.
 1. Verify that rooftop utilities and service piping affected by the Work have been shut off before commencing Work.
- D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. Do not permit water to enter into or under existing membrane roofing system components that are to remain.

3.2 ROOFING COATING PREPARATION

- A. Existing Flashing and Detail Preparation: Repair flashings, gravel stops, copings, and other roof-related sheet metal and trim elements. Reseal joints, replace loose or missing fasteners, and replace components where required to leave in a watertight condition.
 1. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.
- B. Membrane Surface Preparation:
 1. Substrate Cleaning: Clean substrate of contaminants such as dirt, debris, oil, and grease that can affect adhesion of coating by power washing at minimum 2,000 psi.
 2. Verify that existing substrate is dry before proceeding with application of coating. Spot check substrates with an electrical capacitance moisture-detection meter.
 3. Remove blisters, rides, buckles, protruding fastener buttons, and other substrate irregularities from existing membrane that would inhibit application of uniform waterproof coating.
 4. Verify adhesion of new products.
- C. Surface Priming: Prime surfaces to receive fluid-applied coating using coating manufacturer's recommended product for surface material. Apply at application rate recommended by manufacturer.
 1. Ensure primer does not puddle and substrate has complete coverage.
 2. Allow to cure completely prior to application of coating.
- D. Membrane Repair: Repair membrane at locations with irregularities using seam sealer mastic and reinforcing fabric.

3.3 ROOF COATING APPLICATION

- A. Coating, Acrylic Emulsion: Once seam sealer mastic and primer-surfacer have adequately cured, apply coating in number of coats and thickness of application recommended in writing by manufacturer for application.
- B. Apply minimum of two coats. Allow to cure between coats.
- C. Apply at 2 gallons per square per coat. Backroll all coating applications to ensure clean finish with no spray lines and fully bonded coating.

3.4 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.

END OF SECTION

**SECTION 07 21 00
THERMAL INSULATION**

PART 1 – GENERAL

1.02 SUMMARY

A. SECTION INCLUDES

1. Sound Insulation.
2. Thermal Insulation in walls and below roof deck.
3. At fire rated assemblies, provide insulation at fire rated construction only as allowed by the California Building Code.

B. RELATED WORK SPECIFIED ELSEWHERE

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 06 10 00: Rough Framing.

C. REFERENCES:

1. CBC, California Building Code - 2022 Edition, as amended.
2. California Quality Standards for Insulating Materials.

1.02 SUBMITTALS:

A. Submit the following items in accordance with Divisions 00 & 01:

1. List of materials.
2. Product data for each type of insulation specified.
3. Insulation Certificate: Installer shall submit a copy to the Architect and post in a conspicuous location in each building a certificate signed by the installer and the General Contractor stating that the installation conforms with the requirements of CBC 2022 edition, Title 24, Chapter 2–53, and that the materials installed conform with the requirements of the California Quality Standards for Insulating Materials. The certificate shall state the manufacturer's name and material identification and the installed "R" value. Submittal required.
4. Provide color-coated floor plan showing stud depth and necessary batt insulation to fill cavity.

1.03 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to the job site and store in a safe dry place with all labels intact and legible at time of installation.
- B. Protect building insulation materials before installation and protect the installed work and materials of other trades.

- C. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Johns-Manville.
- B. Owens–Corning Fiberglass Corporation
- C. Celotex Corporation
- D. CertainTeed Corporation.
- E. USG Thermafiber (at fire rated construction assemblies where required by listed Design Number).
- F. Approved equal.

2.02 MATERIALS:

- A. **Type A**, Friction-Fit Thermal Insulation: A blanket-like non-fire rated, formaldehyde free product manufactured from inorganic glass fibers for installation in framed exterior walls. The nominal 16 inch, or as required wide blankets shall be faced with a factory applied integral kraft vapor barrier for use at protected spaces and code approved for unexposed applications.
 - 1. Faced insulation shall comply with ASTM C-665, Type II, Class C.
 - 2. Composite Product Fire Hazard Classification Rating as required by the specified codes and standards for use at locations and conditions as indicated.
 - 3. Thickness: As required to fill full depth of wall cavity.
 - 4. Minimum R Value: 19 at 75 degrees F. at 6" or greater walls as shown on Drawings in accordance with ASTM C-518 or C-653.
 - 5. Water Vapor Transmission (permeance): 1.0 perms maximum when tested in accordance with ASTM B-96, desiccant method. Moisture absorption less than 1% by volume.
 - 6. Flame Spread = 25, Smoke Developed = 450. Product is covered by gypsum board wall finish. Flame and smoke ratings do NOT apply to facings per CBC 720.2.1.
 - 7. Use at all non-rated exterior wall and attic wall cavities unless specifically noted otherwise.

2.03 MISCELLANEOUS MATERIALS:

- A. All other materials, such as additional insulation materials, fasteners, line wire, tape and retainers, not specifically described but required for a complete and proper installation of building insulation, shall be subject to submittal approvals.
 - 1. Provide additional insulation materials selected from manufacturer's standard materials. These materials shall conform to the specified Codes, Standards and performance requirements as

indicated in the Contract Documents or as required for the complete and proper construction of the building envelope.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. Prior to all work of this Section, carefully inspect and verify that the installed work of all other trades is complete to the point where this installation may begin.
- B. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in discrepant areas until all such discrepancies have been fully resolved.

3.02 INSTALLATION:

- A. Batt, Blanket Insulation: Provide insulation barrier system with no voids in system. Keep end joints to a minimum. Install with vapor barrier to warm (interior) side. Fit ends and edges tight to framing members. Keep all piping and other work on warm side of insulation. Provide tape vapor barrier joints. Tape as required.
- B. Install fire rated insulation where indicated on the Drawings or where required to maintain the code required integrity of fire-rated assemblies.

3.03 PROTECTION:

- A. Protect installed insulation from damage until covered.

END OF SECTION

SECTION 07 26 00

VAPOR RETARDERS

PART 1 – GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Concrete Vapor Emission Control System for remediation of excessive slab moisture and / or alkyd levels.
2. Repairs and preparation of concrete substrate and to install the concrete vapor emission control system.
3. Subfloor testing after concrete treatment.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Bid Form: Bid Allowance with Unit Cost for potential slab treatment.
3. Section 00 72 00: General Conditions.
4. Section 00 72 00: Exhibit C: Abatement of Hazardous Materials.
5. Section 03 30 00: Concrete Work: Subfloor surface.
6. Section 09 65 00: Resilient Flooring.
7. Section 09 96 56: Epoxy Flooring and Base System.
8. Section 09 68 00: Carpet.

C. REFERENCES

1. ASTM C920-14 – Elastomeric Joint Sealants.
2. ASTM E96 / E96M-16 – Test Method for Water Vapor Transmission of Materials.
3. ASTM F710-11-Practice for Prepping Concrete Floors to Receive Resilient Flooring.
4. ASTM F1869-16 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
5. ASTM F2170-16 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Ten-year experience in producing moisture vapor control emission products.
2. Minimum \$5-million product liability insurance policy from an A-rated carrier.

3. A warranty program covering coats associated with repair or replacement of concrete vapor emission control system and finish floor covering or coating, including repair or replacement labor.

B. Installer Qualifications:

1. Installer shall have experience in the installation of floor covering or floor coatings and shall have experience in the installation of concrete vapor emission control systems.
2. Floor covering installer must be factory trained and certified for the installation of the specific products being installed.
3. Installer to provide project inspector proof of certification prior to starting work.
4. Certified installer must be present on job site while work is in progress.

C. Testing Laboratory Qualifications:

1. Certified, bonded, qualified and experienced agency to perform pH and moisture vapor emission tests.

D. Pre-installation Meeting:

1. Contactor to notify Construction Manager with a minimum of 5-days' notice when anticipated to be ready for pre-installation meeting.
2. Contractor, installer and manufacturer representative are required to attend pre-installation meeting. Contractor is responsible for coordinating and scheduling their attendance.
3. Construction Manager will schedule meeting with Contractor team, Project Inspector, and Architect.
4. Purpose of Meeting: To review subfloor condition and test results; determination of appropriate treatment system(s) and location(s); and review installation requirements.

1.03 SUBMITTALS

- A. Provide a complete submittal package with all components required within this section. Submit per Section 00 72 00.
1. Product Data: Provide product data describing physical and performance characteristics, material safety data sheets, certificates, warranty information and manufacture's installation instructions for proposed product.
 2. Submit product manufacturer's field reports and test reports with warranty certification.
 3. Submit anhydrous calcium chloride testing according to ASTM F1869 and RH Probe Tests results according to ASTM F2170. Submit substrate pH readings. Tests shall be performed by the Owner's Inspector and results provided to the Architect, Owner, General Contractor, flooring installer and Water Vapor Reduction System Manufacturer's Representative.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

- B. Store products in an approved ventilated dry area; protect from dampness, freezing, and direct sun light. Product should not be stored in areas with temperatures in excess of 90 °F or below 50 °F.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Areas to receive Vapor Emission Control System shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature per manufacturer's recommendation.
- B. Maintain ambient temperature required by manufacturer three days prior to, during, and 24 hours after installation of Vapor Emission Control System.
- C. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
- D. Do not apply water vapor reduction system when temperature is lower than 50° F or expected to fall below this temperature within 24 hours from time of application.
- E. Protection: Protect water vapor reduction system to prevent damage from topical water for a minimum period of 24 hours from time of application.

1.06 WARRANTY

- A. Contractor shall file a pre-installation checklist with the manufacturer (as required) and receive written confirmation of the approval to proceed in order to obtain full warranty.
- B. Emission control system warranty must be from the manufacturer, in writing, and cover the cost of system materials, cementitious compounds and labor costs of application and preparation. In addition, the warranty must extend to the flooring material, adhesive and installation labor.
- C. Warranty period shall be no less than ten years or the life of the flooring covering whichever comes first.
- D. Warranty exclusion shall be limited to:
 - 1. Moisture failure due to topical intrusion of plumbing failure or other substances entering from the surfaces.
 - 2. Seismic damage occurring after installation.
 - 3. Replacement of flooring during warranty period as removal of flooring could damage emission control system.
 - 4. Aggregate found to be defective (expansive and reactive aggregate are examples).
- E. Warranty shall not exclude cracks visible at time of installation nor "improper installation".
- F. Manufacturer to provide evidence of a product liability insurance policy. Insurer shall have no less than an "A" rating from one of the four major rating services. A certificate of insurance shall be

delivered to the Owner and shall name the Owner, Architect and General contractor as co-insured. Liability shall be in the amount of \$5 million per occurrence.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Vapor Emission Control System: The appropriate system(s) shall depend on the existing slab moisture and pH levels and the requirements of the specific floor covering product. The determination of which of the following systems would be most appropriate and the extent of treatment area(s) shall be made by the Owner's representative once the existing slab testing results are known.
1. Koester VAP1 2000 System. 100% solids epoxy.
 2. Mapei Planiseal VS System. An alkali-resistant, two-component, 100%-solids epoxy coating that effectively stops moisture-related problems with floor coverings.
 3. ARDEX MC™ RAPID.100% solids epoxy system.

2.02 MIX DESIGNS

A. VAP1 2000:

1. Use clean containers and mix thoroughly as per Manufacturer's requirements 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. Mix ratios are measured by volume.
2. VAP I® 2000 Mix Ratio: Mix Component A and B at a ratio of 2.4:1 by volume.

B. Mapei Planiseal VS:

1. Premix Part A to a homogenous consistency (2 to 3 minutes) using a low-speed mixer (at 300 to 450 rpm) and a "jiffy" (paint mixer) mixing paddle.
2. Pour Part B into Part A container and mix thoroughly to a smooth, homogenous consistency. Do not mix at high speeds, which can trap air within the mixed material.
3. Pour and spread the entire unit of any mixed Planiseal VS onto the substrate within 5 minutes of mixing.

C. ARDEX MC PLUS:

1. Each individual unit of ARDEX MC RAPID™ Red and ARDEX MC RAPID™ Green contains separate, pre-measured quantities of the hardener (Part A) and the resin (Part B). The hardening agent (Part A) is added to the resin (Part B).
2. ARDEX MRP and/or ARDEX K 301 are mixed in 2-bag batches at one time. Mix each bag of powder with the prescribed amount of water using an ARDEX Mixing Paddle and a 1/2" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written installation instructions for each material.

3. For mix designs related to the use of ARDEX underlayment's and toppings, refer to the standard mixing instructions for installation over concrete as shown in the manufacturer's installation instructions.
4. For instructions on the filling of dormant cracks and joints, follow the written instructions of the selected epoxy manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Calcium Chloride, RH Probe and pH test requirements:

1. Anhydrous calcium chloride testing shall be performed by the Owner's Inspector.
2. Provide anhydrous calcium chloride tests according to ASTM F1869 protocol.
3. Provide RH Probe Tests according to ASTM F2170 protocol.
4. Only conduct calcium chloride tests at the same temperature and humidity expected during normal use. If this is not possible then follow the F1869 method for non-acclimated spaces. Maintain these conditions 48 hours prior to and during tests. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature and humidity are NOT acceptable.
5. Provide substrate surface pH readings.
6. Owner's Inspector shall provide test results with a marked-up floor finish plan showing test result. Inspector shall provide a written clarification on status of the ambient air temperature and humidity before and during the testing procedures.

B. Concrete Slab Inspection

1. Existing concrete slabs - Testing for concrete deficiencies and contaminates such as un-reacted silicates, chlorides, A.S.R. (alkali-silica reaction), oil contamination, etc. is recommended by Koster to avoid bonding issues. These conditions can cause bonding concerns with all epoxy and finished floor coatings, including the Koster VAP 1 2000. This testing is not required by Koster. This testing should be performed by the owner's independent testing agency using utilizing standard coring methods and review of the history of the slab installation if available. Concrete should conform to ACI Committee 201 Report "Guide to Durable Concrete."
2. New concrete slabs - Review Section 03 30 00 curing compounds. Silicate based curing compounds should be avoided.

3.02 PREPARATION

- A. Inspect all surfaces with regard to their suitability to receive moisture vapor reduction system with manufacturer's representative.
- B. Clean all surfaces to receive moisture vapor reduction system. Shot blast all floors to a CPS #3 or #4 and clean surfaces with vacuum and remove all residue off the concrete. Grinding is allowed only in areas not accessible by shot blasting. Do not acid etch. Remove ALL defective materials, and foreign matter such as dust, adhesives, gypsum based patching and leveling compounds, paint, dirt, un-

- reacted sprayed on silicates, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, shot blast bee bees, etc. Repair all cracks, expansion joint, control joints, and open surface honeycombs and fill in accordance with Manufacturers recommendations. Inform vapor reduction system manufacturer if concrete additives like silicates or chlorides or any other soluble compounds that have been used in the concrete mix or topically applied. Reinforcing fibers that are visible after shot blasting must be removed and vacuumed leaving no fibers left on the concrete surfaces. Provide uncontaminated, sound surface.
- C. Repair concrete prior to moisture vapor reduction system. Consult with vapor reduction manufacturer to determine suitable products for concrete repair.
 - D. Shot blast a small test area and review surface profile with the finished flooring applicator. As the moisture vapor reduction system is not a leveling material make sure the flooring installer is aware that a feather finish or leveling material may be utilized to “flatten” the concrete after the application of the moisture vapor reduction system and prior to the flooring installation.
 - E. Clean substrate surfaces to receive system treatment and treat surface irregularities with a 100% Portland Cement based patching compounded and cementitious fill compatible with prescribed system treatment as recommended by the manufacturer of the moisture control system.
 - F. At all treated locations under finish goods i.e. carpet, VCT, etc., install self-leveling material to provide a smooth and uninterrupted concrete substrate for proper installation of floor finish.

3.03 JOINT AND CRACK PREPARATION

A. VAP1 2000:

1. Fill cracks, control joints, voids and deteriorated concrete with CTS Cements Rapid Set Cement All, Mortar Mix, Concrete Mix or Skim Coat prior to the VAP I 2000 application. Allow the products to cure according to Rapid Set's requirements before applying the VAP products over the repaired area. Do not use gypsum based cementitious patching, leveling and repair mortars under the VAP I 2000 systems. Cracks should be opened up to at least 1/4" x 1/4" to allow for a proper amount of Rapid Set materials to fill the voids. Any cracks/voids that may be contaminated by known or unknown substances should be routed out to remove any contaminants.
2. Expansion joints should be repaired per the detail on the VAP I 2000 data sheets. A fumed silica epoxy thickening agent (Aerosil or Cabosil) can be added to the VAP I 2000 products and used in place of cementitious materials for control joints and cracks if needed.
3. Consult with Koster America for crack general repair guidelines.

B. Mapai Planiseal VS:

1. Repair cracks before application of the Planiseal VS using an appropriate high-modulus epoxy (Planibond EBA or Planibond CR 50) mixed with sand if required (depending on the size of crack under repair). Cracks narrower than 1/8" (3mm) may typically be filled with Planiseal VS neat. Cracks wider than 1/8" (3mm) are to be repaired with suitable high-modulus epoxy such as Planibond EBA or Planibond CR 50 (consider an epoxy mortar if appropriate) filled to 1/8" to ¼" (3 to 6mm) shy of the substrate surface (just below flush).

2. Avoid overfilling of cracks with high-modulus epoxies that will lead to epoxy spilling onto substrate. Any epoxy that spills onto the substrate surface must be removed, and any remaining residue must be fully seeded with sand. The subsequent application of the Planiseal VS must take place after all loose sand have been vacuumed up off the floor, and fully encapsulate the epoxy utilized for crack repair.
3. Contraction, control or saw-cut joint treatment – Dormant control joints may typically be filled with Planiseal VS, or with Planibond EBA or Planibond CR 50 (consider an epoxy mortar if appropriate) filled to 1/8" to ¼" (3 to 6mm) shy of the substrate surface (just below flush).

C. ARDEX MC:

1. Moving Joints – honor all expansion and isolation joints up through the ARDEX Moisture Control System, and underlayment or topping.
2. Saw cuts, control joints and dormant cracks –To ensure that a continuous barrier to moisture emissions is created over the entire surface, ARDEX recommends the use of a two-part, low viscosity rigid epoxy crack and joint filler to fill small, non-moving cracks and saw-cut joints in existing concrete substrates. Cracks greater than a hairline in width [1/32" (0.79 mm)] and saw-cuts must be filled in strict accordance with the installation instructions provided by the ARDEX Technical Department. Once the dormant cracks and saw-cuts have been properly filled, allow these areas to cure thoroughly in accordance with the epoxy manufacturer's recommendations prior to proceeding with the ARDEX MC™ RAPID installation.
3. Saw Cuts, Control Joints and Dormant Cracks – fill all non-moving joints and cracks greater than 1/32" with a rigid, low-viscosity, two-part epoxy joint sealant. Once the cracks and joints have been properly filled, broadcast a sand layer to refusal and allow these areas to cure as recommended by the epoxy manufacturer prior to proceeding with the installation of the ARDEX MC™ RAPID.

3.04 INSTALLATION (per manufacturer's guidelines or as follows)

- A. The coverage rates vary by system. Follow manufacturer recommendations for the specific project application.
- B. Application of moisture reduction system shall be in strict accordance with manufacturer recommended methods and installation information.
- C. Cementitious underlayment with suitable primer is recommended if required by the Owner, floor covering installer, or the floor covering manufacturer to smooth and/or level surfaces after shot blasting and installation of the moisture reduction system. No underlayment or feather finish system is allowed under the moisture reduction system material. When water-based adhesives are utilized in the floor covering installation, use an approved cementitious underlayment system with primer prior to the installation of the flooring system. Contact the adhesive manufacturer for their minimum recommended thickness of cementitious underlayment to absorb excess moisture in the adhesive. Typically, a minimum of 1/8" is required. Note this is only for some water-based adhesives.

3.05 PROTECTION

- A. Prohibit any traffic or any activity that generates dust or debris from contaminating the treated slab until finished flooring is installed.
- B. Do not install finished flooring until the vapor control system has fully cured in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 07 52 16

SBS MODIFIED BITUMINOUS MEMBRANE ROOFING, HOT-APPLIED

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hybrid Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing system on building substrate (DESIGNER to modify as required for different substrate), including:
 - a. Roof insulation.
 - b. Roof insulation cover board.
 - c. Roof membrane and membrane base flashings.
 - d. Hybrid, built-up asphalt (glass-fiber) roofing ply sheets.
 - e. Granule-surfaced SBS-modified bituminous cap sheet.
 - f. Cool Roof coating.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 05 50 00 – Metal Fabrication.
3. Section 06 10 00 – Rough Carpentry for wood cants, nailers, curbs, and blocking.
4. Section 07 60 00 – Flashing and Sheet Metal for shop- formed sheet metal roof flashings and counter-flashings, including formed copings and roof edge metal items.
5. Section 07 71 23 – Gutters and Related Flashings.

1.02 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.
- B. Hot Roofing Asphalt: Roofing asphalt heated to its equi-viscous 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 degree F. measured at the mop cart or mechanical spreader immediately before application.

1.03 SUBMITTALS

A. Action Submittals

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

B. Informational Submittals

1. 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.
 2. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.
 - a. Include letter from Manufacturer written for this Project indicating approval of Installer.
 3. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing membrane, flashing sheets, adhesives, and sealants.
 4. Warranties: Unexecuted sample copies of warranties.
 5. Field Quality Control Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and Contractor's corrective actions taken to correct defective work.
 - a. Submit reports within 48 hours after installation.
- C. Closeout Submittals
1. Maintenance Data: To include in maintenance manuals.
 2. Warranties: Executed copies of warranties.

1.04 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 qualified by the roofing system manufacturer to install manufacturer's product and furnish warranty of type specified.
- B. Manufacturer Qualifications: Approved manufacturer with UL listed and FM Global approved roofing systems comparable to those specified for this Project, with minimum five years' experience in manufacture of comparable products in successful use in similar applications, and able to furnish warranty with provisions matching specified requirements.
- 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.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site access to manufacturer's written recommendations and instructions for installation of products.

E. Preinstallation Meetings

1. Preinstallation Roofing Conference: Conduct conference at Project site.
 - a. Meet with Owner, Architect, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - b. Review drawings and specifications.
 - c. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Examine substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - f. Review structural loading limitations of roof deck during and after roofing.
 - g. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - h. Review governing regulations and requirements for insurance and certificates if applicable.
 - i. Review temporary protection requirements for roofing system during and after installation.
 - j. Review roof observation and repair procedures after roofing installation.

1.06 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 system 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.

1.07 PROJECT / FIELD CONDITIONS

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

- B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system 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 and insulation with a course of roofing sheet securely in place 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 temporary plugs from roof drains at end of each day.
 4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard or customized form, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
1. Single manufacturer's warranty includes roofing membrane, base flashings, fasteners, roofing membrane accessories and other components of roofing system specified in this Section.
 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Manufacturer Inspection Services: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's inspections is included in the Contract Sum.
1. Inspections to occur in following years: 2, 5, 10, 15 following completion of work.
- C. Installer's Warranty: Submit roofing Installer's warranty, on warranty form, signed by Installer, covering the Work of this Section and related Sections indicated above, including all components of membrane roofing such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.
- D. Warranties specified in this Section include the following components and systems specified in other sections supplied by the roofing system Manufacturer, and installed by the roofing system Installer:
1. Sheet metal flashing and trim, including roof penetration flashings.
 2. Manufactured copings, roof edge, counter-flashings, and reglets.
 3. Roof curbs, hatches, and penetration flashings.
 4. Roof and parapet expansion joint assemblies.
 5. Metal roof, wall, and soffit panels and trim.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Manufacturer/Product:
 - 1. Tremco, Inc. (specified).
 - 2. Or approved equal.
- B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Flashings and Fastening: Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
 - 1. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.
 - 2. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.
- C. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, 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.
- D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.
- E. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.03 MATERIALS

- A. General

1. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

B. Roof Membrane Materials

1. Hybrid System Asphalt (Glass Fiber) Ply Sheets:
 - a. Asphalt and glass-fiber roofing ply sheet for hot-applied built-up roofing systems, ASTM D2178 Type IV.
 - 1) Basis of design product: Tremco, THERMglass Type IV.
 - 2) Net Dry Mass of asphalt impregnated glass felt, ASTM D146: 7.5 lb/100 sq ft.
 - 3) Breaking Strength, ASTM D146: 44 lbf/in.
 - 4) Pliability, 1/2 inch, ASTM D146: Pass.
2. SBS Modified Bituminous Cap Sheet:
 - a. SBS-modified asphalt-coated glass-fiber-reinforced sheet, granular surfaced, ASTM D6163 Type I Grade G.
 - 1) Basis of design product: Tremco, POWERply Standard FR.
 - 2) Exterior Fire-Test Exposure, ASTM E108: Class A.
 - 3) Tensile Strength at 77 degree F, minimum, ASTM D5147: Machine direction 80 lbf/in; Cross machine direction 75 lbf/in.
 - 4) Tear Strength at 77 degree F, minimum, ASTM D5147: Machine direction, 100 lbf; Cross machine direction 108 lbf.
 - 5) Elongation at 77 degree F, minimum, ASTM D5147: Machine direction 7 percent; Cross machine direction 8 percent.
 - 6) Low Temperature Flex, maximum, ASTM D5147: -15 degree F.
 - 7) Thickness, minimum, ASTM D5147: 0.120 inch.
3. Flashing Backer Sheet:
 - a. Asphalt and glass-fiber roofing ply sheet for hot-applied built-up roofing systems, ASTM D2178 Type IV.
 - 1) Basis of design product: Tremco, THERMglass Type IV.
 - 2) Net Dry Mass of asphalt impregnated glass felt, ASTM D146: 7.5 lb/100 sq ft.
 - 3) Breaking Strength, ASTM D146: 44 lbf/in.
 - 4) Pliability, 1/2 inch (13 mm), ASTM D146: Pass.
4. Flashing Sheet:
 - a. SBS-modified asphalt-coated glass-fiber-reinforced sheet, granular surfaced, ASTM D6163 Type I Grade G.
 - 1) Basis of design product: Tremco, POWERply Standard FR.
 - 2) Exterior Fire-Test Exposure, ASTM E108: Class A.
 - 3) Tensile Strength at 77 degree F, minimum, ASTM D5147: Machine direction 80 lbf/in; Cross machine direction 75 lbf/in.
 - 4) Tear Strength at 77 degree F, minimum, ASTM D5147: Machine direction, 100 lbf; Cross machine direction 108 lbf.
 - 5) Elongation at 77 degree F, minimum, ASTM D5147: Machine direction 7 percent; Cross machine direction 8 percent.

- 6) Low Temperature Flex, maximum, ASTM D5147: -15 degree F.
- 7) Thickness, minimum, ASTM D5147: 0.120 inch.

5. Detailing Fabric:

- a. Woven Glass Fiber Mesh, Vinyl-Coated: Non-shrinking, non-rotting, vinyl-coated woven glass mesh for reinforcing flashing seams, membrane laps, and other roof system detailing.
 - 1) Basis of design product: Tremco, BURmesh.
 - 2) Tensile strength, 70 degree F, min ASTM D146: Warp, 65 lbf/in; fill, 75 lbf/in.
 - 3) Color: Aqua green.

C. Asphalt Materials

1. Asphalt primer, water-based, polymer modified.
 - a. Basis of design product: Tremco, TREMprime WB.
 - b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 2 g/L.
 - c. Color: Brown/black.
2. Hot-melt asphalt adhesive, ASTM D312 Type IV.
 - a. Basis of design product: Tremco, Premium IV Adhesive.
 - b. Softening Point, min/max, ASTM D36: 215–225 degree F.
 - c. Ductility at 77 degree F, minimum, ASTM D113: 1.5 cm.
 - d. Penetration at 77 degree F, min/max, ASTM D5: 15–25 dmm.

D. Auxiliary Membrane Roofing Materials

1. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
 - a. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Asphalt Roofing Cement / Mastic:
 - a. Seam Sealer and Patching Sealer: Acrylic elastomeric sealer, single-component, high solids, low-VOC, formulated for compatibility and use with specified roofing and wall substrates.
 - 1) Basis of design product: Tremco, SOLARGARD Acrylic Sealer.
 - 2) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 50 g/L.
 - 3) Tensile Strength, minimum, ASTM D412: 450 psi.
 - 4) Hardness, Shore A: 45.
 - 5) Elongation, minimum, ASTM D412: 300 percent.
 - 6) Impact Resistance, minimum: 160 in/lb.
 - b. Roof Cement, Asphalt-Based: ASTM D4586, Type II, Class I, fibrated roof cement formulated for use in installation and repair of asphalt ply and modified bitumen roofing plies and flashings; UL-classified for fire resistance.
 - 1) Basis of design product: Tremco, ELS.
 - 2) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 190 g/L.
 - 3) Non-Volatile Matter, ASTM D4586: 85 percent.
 - 4) Resistance to sag ASTM D4586: 1/8 in.
3. Stripping Reinforcing Fabric:

- a. Polyester Reinforcing and Protection Fabric: 100 percent stitch-bonded mildew-resistant polyester fabric intended for reinforcement of compatible fluid-applied membranes and flashings and as a protection layer under pavers or stone aggregates.
 - 1) Basis of design product: Tremco, Permafab.
 - 2) Tensile Strength, Minimum, ASTM D1682: 50 lbf avg.
 - 3) Elongation, Minimum, ASTM D1682: 60 percent.
 - 4) Tear Strength, Minimum, ASTM D1117: 16 lbf avg.
 - 5) Weight: 3 oz./sq. yd.
 4. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
 5. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."
 6. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.
- E. Roof Insulation Materials
1. Roof Insulation, General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
 - a. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.
 2. Roof Insulation:
 - a. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.
 - 1) Compressive Strength, ASTM D1621: Grade 2: 20 psi.
 - 2) Conditioned Thermal Resistance at 75 degree F: 14.4 at 2.5 inches thick.
- F. Accessories
1. Roof Insulation Cover Board:
 - a. Gypsum panel, glass-mat-faced, primed, ASTM C1177/C1177M.
 - 1) Basis of design product: Tremco/GP Gypsum DensDeck Prime.
 - 2) Thickness: 1/2 inch.
 2. Roof Insulation Adhesive:
 - a. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.
 - 1) Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.
 - 2) Flame Spread Index, ASTM E84: 10.

- 3) Smoke Developed Index, ASTM E84: 30.
 - 4) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.
 - 5) Tensile Strength, minimum, ASTM D412: 250 psi.
 - 6) Peel Adhesion, minimum, ASTM D903: 17 lbf/in.
 - 7) Flexibility, 70 degree F (39 degree C), ASTM D816: Pass.
- b. Hot-melt asphalt adhesive, ASTM D312 Type IV.
- 1) Basis of design product: Tremco, Premium IV Adhesive.
 - 2) Softening Point, min/max, ASTM D36: 215–225 degree F.
 - 3) Ductility at 77 degree F minimum, ASTM D113: 1.5 cm.
 - 4) Penetration at 77 degree F, min/max, ASTM D5: 15–25 dmm.
3. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
 4. Tapered Edge Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
 5. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

G. Surfacing Materials

1. Cool Roof Acrylic Emulsion Flashing Coating Material:
 - a. Acrylic Roof Coating, Highly-Reflective Elastomeric: high-solids acrylic latex elastomeric roof coating formulated for use on bituminous roof surfaces; water-based, Energy Star qualified, CRRR listed and California Title 24 Energy Code compliant.
 - 1) Basis of design product: Tremco, ICE Coating.
 - 2) Volatile Organic Compounds (VOC), ASTM D3960: 39 g/L.
 - 3) Emissivity, minimum, ASTM C1370: 0.83.
 - 4) Solar Reflectance Index (SRI), ASTM E1980: 103 (initial) 75 (3 year aged).
 - 5) Reflectance, minimum, ASTM C1549: 84 percent.
 - 6) Solids, by volume, ASTM D5201: 65 percent.
 - 7) Minimum Thickness: 45 mils dry film thickness.

PART 3 - EXECUTION

3.01 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, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation. wood cants

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

3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system 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.

3.03 INSTALLATION

A. General

1. Install roofing system in accordance with manufacturer's written instructions, approved shop drawings, and Contract Documents.
2. Install wood cants, blocking, curbs, and nailers in accordance with requirements of Division 06 Section "Miscellaneous Rough Carpentry."
3. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

B. Insulation Installation

1. Comply with built-up roofing manufacturer's written instructions for installing roof insulation.
2. Coordinate installing membrane roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
3. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.
4. Tapered Insulation and Crickets: Install tapered insulation under area of roofing to conform to slopes indicated.
 - a. Where crickets are indicated or required to provide positive slope to drain, make slope of crickets minimum of two times the roof slope, not less than 1/4 inch in 12 inches (1:48).
5. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
6. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
7. Adhered Insulation Application Method: Install each layer of insulation and adhere to substrate as follows:
 - a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
8. Cover Board Installation: 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. Tape joints if required by roofing manufacturer.
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining board-in place.

C. Hot-Applied Roofing Membrane Installation, General

1. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roofing" and as follows:
 - a. Number of Asphalt (Glass-Fiber) Ply Sheets: Three.
 - 1) Adhering Method: Mopped.
 - b. Granular-Surfaced SBS-Modified Asphalt Cap Sheet:
 - 2) Adhering Method: Mopped.
2. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
3. Cooperate with testing agencies engaged or required to perform services for installing roofing system.
4. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - a. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in compatible roofing cement/mastic or hot roofing asphalt, with joints and edges sealed.
 - b. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
 - c. Remove temporary plugs from roof drains at end of each day.
 - d. Remove and discard temporary seals before beginning work on adjoining roofing.
5. Hot Roofing Asphalt Heating: Heat asphalt to its equi-viscous temperature, measured at the mop cart or mechanical spreader immediately before application. Circulate asphalt during heating. Do not raise asphalt temperature above equi-viscous temperature range more than one hour before time of application. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating. Do not heat asphalt within 25 degree F of flash point. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
 - a. Apply hot roofing asphalt within plus or minus 25 degree F. of equi-viscous temperature and adhere components to asphalt heated to not less than 425 degree F.
6. Hot Roofing Asphalt Heating, SEBS-Modified Asphalt: Heat and apply SEBS-modified elastomeric roofing asphalt according to roofing system manufacturer's written instructions.
7. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

D. Ply Sheet Installation

1. Install ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align base-ply sheets without stretching. Extend sheets over and terminate beyond cants.
 - a. Shingle side laps of ply sheets uniformly to ensure that required number of ply sheets covers substrate at any point. Shingle in direction to shed water.

- b. Embed each glass-fiber ply sheet in a continuous void-free mopping of hot roofing asphalt to form a uniform membrane without glass-fiber ply sheets touching.

E. SBS-Modified Bituminous Membrane Installation

1. Install modified bituminous roofing membrane cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
 - a. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
 - b. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 degree F.
2. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Install roofing membrane sheets so side and end laps shed water. Completely bond and seal laps, leaving no voids.
 - a. Repair tears and voids in laps and lapped seams not completely sealed.
 - b. Apply roofing granules to cover exuded bead at laps while bead is hot.

F. Flashing And Stripping Installation

1. Base Flashing Installation, General: Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:
 - a. Extend base flashing up walls or parapets a minimum of 12 inches above modified bituminous roofing and 6 inches onto field of roof membrane.
 - b. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - c. Backer Sheet Installation:
 - 1) Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
 - d. Flashing Sheet Installation:
 - 1) Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - e. Flashing Sheet Top Termination: Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - 1) Seal top termination of base flashing with a metal termination bar and a continuous bead of joint sealant.
 - f. Flashing Sheet Bottom Termination: Adhere flashing sheet to roof membrane sheet continuously along bottom of flashing sheet.
2. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.
3. Install stripping, according to roofing manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.

4. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of compatible mastic/adhesive sealer, as recommended by roofing manufacturer, and extend onto roofing membrane. Apply number of courses recommended by manufacturer.
5. Roof Drains: Set 30 by 30-inch square metal flashing in bed of compatible mastic/adhesive sealer on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 6 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - a. Install stripping according to roofing system manufacturer's written instructions.

G. Surfacing And Coating Installation

1. Acrylic Emulsion Coating:
 - a. Apply Cool Roof coating to the roof and flashings in two coat process at 2 gallons per square per coat.
 - b. Back-roll 2nd coat for clean finish with no spray lines.

3.04 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at commencement and upon completion.
 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- B. 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 if replaced or additional work complies with specified requirements.

3.05 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of 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.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 SUMMARY

- A. All applicable portions of Division 1, including the drawings and general provisions of the contract, the general and supplementary conditions and Division 1 specification sections which apply to work of this section as if printed herein.
- B. Section Includes:
 - 1. Flashings, counter flashings, and copings as indicated on the Drawings and specified herein.
- C. Related Sections:
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Section 07 54 19 – Polyvinyl-Chloride Roofing.
 - 3. Section 07 71 23 – Gutters and Related Flashings.
 - 4. Section 07 90 00 – Joint Sealants.

1.02 REFERENCES

- A. Fabricate sheet metal items from sheet steel in accordance with ASTM G90.
- B. ASTM A924 / A924M-16ae1 - General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
- C. FS TT-C 494B – Federal Specification for Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- D. SMACNA - Architectural Sheet Metal Manual, current edition.
- E. AWS - American Welding Society.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate locations, configurations, jointing methods, welding methods, fastening methods, expansion joint layouts, downspout layout and installation details.
- C. Samples: Submit two samples, 12 inches long illustrating component design, finish, color, and configuration.

1.04 QUALITY ASSURANCE

- A. Conform to SMACNA Manual for architectural sheet metal flashing and installation details.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Where general flashing pieces are shown on drawings, provide steel sheet metal of at least 22-gauge steel unless otherwise noted on drawings.
- B. Where sheet aluminum is shown on Drawings, provide 0.032-inch thickness (20-gauge) and in accordance with ASTM B209, 6063-T5 in color finish as selected by Architect.
- C. Extruded Aluminum: Manufacturer's standard extrusions of sizes and profiles indicated, 60063-T52, AA-C22A41 clear anodized finish; 0.080-inch minimum thickness for primary legs of extrusions.
- D. Stainless Steel: AISI Type 302/304, complying with ASTM A167, 2D annealed finish, soft, except where harder temper required for forming or performance; 0.0156-inch thick (28 gauge) except as otherwise indicated.
- E. Galvanized Steel: ASTM A924 / A924M-09a, Grade A, G90 zinc coating.

2.02 ACCESSORIES

- A. Fasteners and Clips: Provide as required and appropriate for the materials being fastened. Where fasteners or clips may be exposed to outside weather conditions, provide galvanized or stainless-steel type.
 - 1. Provide fasteners such as bolts, screws, and nails hot-dip galvanized as specified in accordance with ASTM A153.
- B. Where rivets will be used, provide malleable iron type with rust-inhibitive coating.
- C. If drive pins are incorporated into work, provide Omark or other approved, cadmium plated with neoprene facing, at least 1-inch long, with neoprene washers.
- D. Solder: For use steel or copper, provide 50 – 50 tin/lead solder (ASTM B32) with rosin flux.
- E. Solder: For use with stainless steel, provide 60 – 40 tin/lead solder (ASTM B32) with acid-chloride type flux, except use rosin flux over tinned surfaces.
- F. Bituminous Coating: SSPC – Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- G. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.

- H. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 90 00 Joint Sealers.
- I. Epoxy Seam Sealer: Two-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
- J. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- K. Paper Slip Sheet: 5 lbs. rosin-sized building paper.
- L. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E154.
- M. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.
- N. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

2.03 FABRICATION

- A. General Metal Fabrication:
 - 1. Shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.
 - 2. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed seams with epoxy seam sealer; rivet joints for additional strength where required.
- B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, in edges to be seamed, form seams and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weather/waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from incompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed for extruded aluminum joint covers. Fabricate mitered and welded corner units.

2.04 PREFABRICATED SHEET METALS

- A. Copings: Provide factory prefabricated 22-gauge galvanized steel sheet metal continuous snap on type copings per SMACNA Chapter 3, Figure 3-1 with EIEPGE Styles. Copings shall be maximum 10-foot lengths, secured at one (1) end and free at other end and/or per SMACNA requirements. Cover plate shall extend 6-inch minimum beyond 1/2-inch space between coping lengths. Secure cover plate with screw in neoprene washer per SMACNA Figure 3-1-Detail 1 in oversized holes. Provide copings manufactured by MM Systems Corporation, Construction Specialties, Tremco, KC Metals, Fry Reglet or others, as approved by Architect.
 - 1. Pre-finish coping in Kynar 500 coating of standard color as selected by Architect.
- C. All other flashing: Provide minimum 22-gauge galvanized flashing to the sizes and shapes as detailed on the drawings. All exposed flashing shall be primed and painted per the paint specification sections. Provide minimum two (2) coats of paint.
- D. Expand-O-Flashing, for Expansion Joints at Roof Expansions and Roof/Wall Expansion Joint Conditions: Provide factory Expand-O-Flash by Johns Manville or equal. Provide 10 foot or maximum lengths possible. Fabricate Expand-O-Flash expansion joint covers as detailed on the drawings. Use Type N-Neoprene Sheet-Black, flange shall be minimum 26 ga. galvanized steel bellows width minimum 4 inches.
- E. Expansion and Seismic Covers for Expansion Joints and Seismic Joints for Floors, Ceilings, Walls and Roofs: Provide factory aluminum joint covers by Balco Inc. or equal. Provide maximum lengths possible. Fabricate expansion and seismic joints covers Model No. RDA-4 with aluminum center plate. Provide extruded aluminum sub-channel (6063-T5) standard mill finish. Movement capabilities shall be at 50 percent or as recommended by the manufacturer.
 - 1. At Rated Expansion and Seismic Joint Conditions up to 2 Hour Rated Systems: Use Balco Fire Barrier Systems as tested in accordance with ASTM E1966 and as listed with Omega Point Laboratories Inc.
 - 2. Expansion and Seismic Joint Covers at Interior, Vertical, and Ceiling Surfaces: Use 6000 Series No. 6GOU- Aluminum snap lock cover plate with standard aluminum mill finish.
 - 3. Expansion and Seismic Joint Cover at Exterior Vertical and Ceiling/Soffit Surfaces: Use FCWW aluminum with standard mill finish.

- F. All Expansion and Seismic Covers that intersect at Floor to Wall, Wall to Ceiling/Soffit, Roof to Parapet, etc.: Use factory preassembled transition pieces that will meet the manufacturers' minimum requirement for a watertight intersection connection.
- G. Balconies Edge Flashing: Use Schluter-Bara-Rak powder-coated aluminum edging profile with drip lip. Extruded aluminum to ASTM B221, 6463-T5 alloy with integral trap E201-DAL-perforated anchoring leg and complete with outside/inside corners and connectors. Length 8 ½ inches long. Color from standard color. Use a thin set mortar over the trapezoid perforated anchoring leg. Apply waterproof membrane per manufacturers' requirements.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Inspect substrate conditions prior to installation of sheet metal items. Conditions which could be detrimental to correct and proper installation of sheet metal assemblies are to be called to the attention of the Owner for their disposition prior to sheet metal work being installed.
- B. Coordinate fabrication and installation of sheet metal items with work of others such as roofing, curtainwall and windows, sealants, mechanical and electrical.

3.02 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal 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 weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, finish reglets to trades of masonry work, for installation as work of Division 4 sections.
- E. Install counter flashings in reglets, either by snap-in seal arrangement or by welding in-place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated in depending on degree of sealant exposure.
- F. Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement as joints by forming loops or bellows in width of flashing. Locate cover or

- filler strips at joints to facilitate complete drainage of water for flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.
- G. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.
 - H. Conductor Head Guards: Install "bee-hive type" strainer-guard at conductor heads, removable for cleaning downspouts.
 - I. Flash around exterior openings in the building where other waterproofing methods are insufficient.
 - J. Joints
 1. Typically, provide flat locked joints with sealant between metal surfaces, unless shown otherwise. Where standing seams are required, provide with folded corners.
 2. Provide minimum of 3-inch laps.
 3. Where concealed joints are possible, provide flat locked joints with 3-inch reinforcing behind, set-in full bed of sealant.
 4. Do not leave sheet metal joint unsealed. See sealant section of these specifications.

3.03 INSPECTION

- A. Immediately following installation of sheet metal work, touch-up areas where primer has been removed during installation operations and where soldering has occurred.
- B. Where architectural coatings are provided, touch-up marred or abraded finishes with compatible coating which can be expected to provide the same serviceability as factory applied coatings.

3.04 CLEANING

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

3.06 PROTECTION

- A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

SECTION 07 71 23
GUTTERS AND RELATED FLASHINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes

1. Galvanized steel gutters.
2. Downspouts.
3. Related flashing.

B. Related Sections

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 05 50 00: Metal Fabrications.
3. Section 07 60 00: Sheet Metal Flashing and Trim.
4. Section 07 52 16: SBS modified Bituminous Membrane Roofing.
5. Section 07 90 00: Sealants.
6. Refer to Division 7, for Roofing Sections, and Prefabricated roof curbs, hatches, roof deck insulation, and Division 8 component daylight systems.
7. Section 09 91 00: Painting - For field painting of metal surfaces.

1.02 REFERENCES

- A. ASTM A924 / A924M-16ae1 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- B. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- C. SMACNA - Architectural Sheet Metal Manual, current edition.
- D. AWS - American Welding Society.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate locations, configurations, jointing methods, welding methods, fastening methods, expansion joint layouts, downspout layout and installation details.
- C. Samples: Submit two samples, 12 inches long illustrating component design, finish, color, and configuration.

1.05 QUALITY ASSURANCE

- A. Conform to SMACNA Manual for architectural sheet metal flashing and installation details.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 66 00.
- B. Stack pre-formed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.07 COORDINATION

- A. Coordinate painting portions prior to installation and the work with downspout discharge pipe inlet.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Galvanized Steel: ASTM A924 / A924M-09a, Grade A, G90 zinc coating.
- B. Schedule 10 galvanized pipe.

2.02 COMPONENTS

- A. Gutters: 18-gauge core steel. Minimum size shall be 6"x6" or as otherwise shown on drawings.
- B. Downspouts: Finished grade to bottom of gutter shall be schedule 10 galvanized pipe, round shape only, 3" minimum diameter or size as shown on drawings.

2.03 ACCESSORIES

- A. Anchorage Devices: SMACNA requirements.
- B. Gutter Supports: Straps.
- C. Fasteners: Galvanized steel or stainless steel and as specified in Section 05 50 00. Finish exposed fasteners same as flashing metal.
- D. Clean out Tee: Smith 4510 cleanout tee with countersunk plug and round access cover. 4", 5" or sized as required to coordinate with downspout and underground piping sizes.
- E. Touch-up Primer: Cold applied zinc-rich type.
- F. Protective Back Coating: FS TT-C-494, bituminous.

- G. Sealant: Type as specified under Section 07 90 00.
- H. Conductor-Head Guards: 20-gauge bronze or nonmagnetic stainless-steel mesh or fabricated units, with salvaged edges and noncorrosive fasteners. Select materials for compatibility with gutters and downspouts.
- I. Overflow Drain: 18 ga. galvanized sheet metal. Approximately 2 inches high by 2 inch diameter.

2.04 FABRICATION

- A. Form gutters of profiles and size indicated, to SMACNA requirements.
- B. Gutters shall be fascia mounted whenever possible. See drawings for additional mounting information.
- C. Fabricate with required connection pieces.
- D. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- E. Hem all exposed edges of metal.
- F. Welding process shall be Metallic Inert Gas (MIG).
- G. Weld all shop formed metal joints. Grind exposed joints flush with adjacent surfaces and apply touch-up primer as specified.
- H. Butt weld all field assembled gutter sections. Grind exposed joints flush with adjacent surfaces and apply touch-up primer as specified.
- I. Fabricate gutter sections with SMACNA butt type expansion joints at 40 feet maximum with a minimum of one (1) downspout in each 40 foot section. Provide additional downspouts as necessary to accommodate expansion joint locations.
- J. All joints shall be watertight per SMACNA standards.
- K. All downspouts shall have fully welded joints and be ground smooth. Provide T-shaped bracket welded to back of downspout for bolting to building. See drawings for additional information.
- L. All downspouts that spill to grade shall have a 45-degree elbow of same pipe profile fully welded to bottom of downspout.
- M. All downspouts connecting to underground storm drainage systems shall be provided with a cleanout tee at grade.

- N. At all individual gutter sections, provide an overflow drain at opposite end of gutter from downspout. Overflow drain shall be fully welded to gutter bottom. I.D. shall match the I.D. for the downspout outlet.

2.05 FINISHES

- A. Field paint gutters under provisions of Section 09 91 00.
- B. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install gutters and downspouts as shown on drawings. Install expansion joints, additional downspouts and accessories as specified.
- B. Field assemble (weld) gutter sections at “ground level” wherever possible and lift into place as one unit.
- C. All downspout sections shall be fully welded, ground smooth, primed and painted. All downspouts shall be mechanically fastened to building at top, bottom, and maximum 6 feet on center.
- D. Install gutters level and straight in line with building. Shim horizontally and vertically as required to level. Installed gutter to have no ponding water more than ¼” deep.
- E. Water test all gutters and downspouts for leaks and ponding in presence of IOR.
- F. At all welded connections, end caps, overflows, and outlets, provide bituminous coating minimum 1 inch each side of joint.
- G. Provide 3-inch closure plate at all gutter expansion joint locations.

END OF SECTION 07 71 23

SECTION 07 90 00

JOINT SEALERS

PART 1 – GENERAL

1.01 SUMMARY

A. SECTION INCLUDE

1. Preparing sealant substrate surfaces.
2. Concrete Joint Sealants.
3. Sealant and backing.
4. Fireproof Firestopping and fire-safing materials and accessories.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 00 72 13: General Conditions.
3. Section 03 30 00: Cast-In-Place Concrete.
4. Section 07 60 00: Flashing and Sheet Metal: Sealants used in conjunction with metal flashings.
5. Section 07 71 23: Gutters and Related Flashings.
6. Section 08 11 00: Metal Doors and Frames: Perimeter sealants.
7. Section 09 29 00: Gypsum Board Systems.
8. Division 22: Mechanical.
9. Division 26: Electrical.
10. Section 32 16 00: Site Concrete.

C. REFERENCES

1. ASTM C834 Standard Specification for Latex Sealants.
2. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
5. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems.
6. FM (Factory Mutual) - Fire Hazard Classifications.
7. UL - Fire Hazard Classifications.
8. UL 263 – Standard for Fire Tests of Building Construction and Materials.
9. UL 723 - Test for Surface Burning Characteristics of Building Materials.
10. UL 1479 - Fire Tests of Through-Penetration Firestops.
11. FS TT S 00227 Sealing Compound: Elastomeric Type, Multi-Component.
12. FS TT S 00230 Sealing Compound: Elastomeric Type, Single Component.
13. FS TT S 001543 Sealing Compound, Silicone Rubber Base.

1.02 SUBMITTALS

- A. Submit manufacturer's product data under provisions of Section 01 33 00 for each product required.
- B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, and color availability.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit standard color ranges of exposed materials for Architect selection.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years' experience.
- B. Applicator: Company specializing in applying the work of this section with minimum three years' experience, with projects of a similar size and type.
- C. Conform to Sealant Waterproofing and Restoration Institute requirements for materials and installation.
- D. Prior to installation of joint sealants, field test adhesion to joint substrates.
 - 1. Install joint sealants in 5-foot joint lengths. Allow to cure before testing. Test adhesion by pulling sealant out of joint.
 - 2. Perform field tests for each type of elastomeric sealant and joint substrate.
 - 3. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
 - 4. Report whether or not sealant in joint connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 - 5. Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrate during testing.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not install solvent curing sealants in enclosed building spaces.
- B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- C. Do not install sealants under adverse weather conditions or when temperatures are above or below manufacturer's recommended limitations for installation.

- D. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

1.05 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with all Sections referencing this Section.

1.06 WARRANTY

- A. Provide two-year warranty for materials and workmanship under provisions of Section 01 33 00.
- B. Warranty: Include coverage of installed sealants and accessories which fail to achieve airtight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 – PRODUCTS

2.01 SEALANTS

- A. Silicone Sealant: Silicone Sealant (use at concrete, masonry, or glazing applications): FS TT S 01543, Class A, low modulus type; Spectrum I as manufactured by Tremco, Inc.
- B. Interior Building Sealant: Acrylic-emulsion; one-part, non-sag, mildew-resistant. Complying with ASTM C834, formulated to be paintable; Pecora Corp. "AC-20", Sonneborn "Sonolac", Tremco Inc. "Tremco Acrylic Latex 834" or approved equal.
- C. Sanitary Sealant: One-part mildew-resistant silicone; ASTM C920 Type S; Grade NS Class 25; Uses NT, G, A and O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures; Dow Corning Corp. "786 Mildew Resistant", or approved equal.
- D. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, non-skinning, non-staining, gun-able, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound; Pecora Corp. "BA-98", Tremco Inc. "Tremco Acoustical Sealant" or approved equal.
- E. Acoustical Sealant for Exposed Joints: Nonoxidizing, skin-able, paintable, gun-able sealant recommended for sealing interior exposed joints to reduce transmission of airborne sound; Pecora Corp. "AC-20", USG "Sheetrock Acoustical Sealant" or approved equal.
- F. Concrete Expansion Joints: Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be chosen from the full range of manufacturer's standard colors.
- G. Vertical Building Expansion Joints: Joint sealing material shall be a one-component, polyurethane-based non-sag elastomeric sealant. Product shall be Sikaflex Construction Sealant as manufactured

Sika Corporation, Pecora Corp. "DynaTrol II" or approved equal. Color shall be chosen from the full range of manufacturer's standard colors.

- H. Sheet Metal Flashings, Trims, Gutters, & Joints: Joint sealing material shall be a two-component, self-leveling, polyurethane elastomeric sealant. Product shall be Sikaflex 2cSL as manufactured Sika Corporation, or equal. Color shall be chosen from the full range of manufacturer's standard colors. Provide Sikaflex 260 Primer at all stainless steel and/or galvanized substrate location for proper adhesion of Sikaflex 2cSL.
- I. Substitutions: Under provisions of Section 01 33 00.
- J. Color of sealant shall be as selected by Architect.

2.02 FIRESTOPPING SEALANTS (consider moving to own section)

- A. Firestopping Material: One-Piece insert conforming to the following:
 - 1. All fire stopping shall be one part, two stage intumescent sealants and putty.
 - 2. All fire stopping sealants shall be capable of maintain an effective barrier against flame, heat, and smoke in compliance with the requirements of ASTM E814, UL 1479, ASTM E119, UL 723, ASTM E84 and UL 263.
 - 3. Fire stopping materials shall be classified in the Underwriters Laboratories (UL) Fire Resistance Directory or listed in the Warnock Hersey International Directory.
 - 4. Fire stopping materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.
 - 5. Acceptable Manufacturers: Hilti Firestop Systems, International Protective Coating Corporation "Flamesafe" Systems, 3M Fire Protection Products or approved equal.
 - 6. Substitutions: Under provisions of Section 01 25 13.

2.03 ACCESSORIES

- A. Primer: Non staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Noncorrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Non-staining; compatible with sealant and primer; such as round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used. Sealant shall not adhere to back-up material.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- E. Solvents: cleaning agents or other accessory materials shall be as recommended by the sealant manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Beginning of installation means installer accepts existing surfaces.

3.02 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with sealant manufacturer's recommendations.
- E. Protect elements surrounding the work of this Section from damage or disfiguration.
- F. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.
- G. Clean metal, glass, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

3.03 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Caulk all exterior joints and openings in the building envelope that are observable sources of air infiltration.
- C. Measure joint dimensions and size materials to achieve required width/depth ratios.
- D. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width. Roll the material into the joint to avoid lengthwise stretching. Do not twist or braid rod stock.
- E. Install bond breaker where joint backing is not used.
- F. Prime surfaces to receive joint sealant with primer recommended by sealant manufacturer.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges. Apply masking tape where required to protect adjacent surfaces from sealant application.
- H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

- I. Tool joints concave.
- J. At all surface-mounted light fixtures mounted on gypsum board ceilings, contractor shall caulk light fixture body to ceiling finish to eliminate gap between metal body and fixture. Coordinate locations with drawings.
- K. Firestopping:
 - 1. Apply materials in exact accordance with manufacturer's latest published instructions, requirements, specifications, details and approved submittals.
 - 2. Installation shall be in accordance with the appropriate UL Fire Resistance Directory or Listing with the appropriate Warnock Hersey International Listing.
 - 3. Seal holes or voids made by penetrating items to ensure an effective fire and smoke barrier.
 - 4. Seal intersections and penetrations of floors, ceilings, walls and columns.
 - 5. Seal around cutouts for lights, cabinets, pipes, plumbing, HVAC ducts and electrical boxes, etc.
 - 6. Where floor openings are four inches or more in width and subject to traffic or loading, install cover plate systems capable of supporting same loading as floor.
 - 7. Interface with Other Projects: Coordinate and cooperate with adjacent, contiguous and related materials trades, (such as concrete, drywall, plumbing, conduit, electrical wiring, communication systems) to ensure a proper and timely installation.
 - 8. Seal steel deck flute openings.

3.04 CLEANING AND REPAIRING

- A. Clean work under provisions of Section 01 77 00.
- B. Clean adjacent soiled surfaces. Use a solvent or cleaning agent as recommended by the sealant manufacturer.
- C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 66 00.
- B. Protect sealants until cured.
- C. Do not paint sealants until sealant is fully cured.
- D. Do not paint silicone sealant.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Non-rated and fire rated rolled steel doors, panels, and frames.
2. Louvers.

B. Referenced Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 14 00 - Wood Doors and Frames.
3. Section 08 71 00 - Door Hardware.
4. Section 08 80 00 - Glazing.

1.02 REFERENCES

- A. ANSI A250 .8 – Recommended Specification for Standard Steel Doors and Frames.
- B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
- C. ANSI A250 .10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- D. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot- Dip Process.
- E. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. CEC - California Energy Commission.
- G. NFPA 80 - Fire Doors and Windows.
- H. SDI-105 - Recommended Erection Instructions for Steel Frames.
- I. DHI - Door and Hardware Institute.
- J. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.

K. UL 9 - Fire Tests of Window Assemblies.

L. UL 10C - Fire Tests of Door Assemblies.

1.03 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8.

B. Fire rated door, panel and frame construction to conform to UL 9 and UL 10C.

C. Installed frame and door assembly to conform to NFPA 80 for fire rated class indicated on Drawings.

D. Installed exterior frame and door assembly to be weather tight

E. Manufacturer shall have both fabrication and assembly plant located within the continental United States or Canada. Products that are either fabricated or assembled outside the continental United States or Canada are not acceptable.

1.04 SYSTEM REQUIREMENTS

A. Performance Requirements

1. Thermal Performance: Glazed exterior borrowed lite, side lite and transom lite frames shall have an overall minimum u-value of 1.19 as rated in accordance with the default table method approved by the California Energy Commission (CEC). Provide Label Certificate FC-1, Figure 3-3, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-A.
2. Solar Heat Gain Coefficient: Glazed exterior borrowed lite, side lite and transom lite frames shall have an overall maximum solar heat gain coefficient of 0.68 as rated in accordance with default table method approved by the California Energy Commission (CEC). Provide Label Certificate FC-1, Figure 3-3, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-B.

A. Regulatory Requirements

1. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 for fire rated frames and doors.
2. Conform to CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, for u- value and solar heat gain coefficient.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.

- B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.
- C. Indicate door elevations, internal reinforcement, closure method, and cut outs for glazing and louvers.
- D. Submit two (2) samples of exterior frame profile at mullion intersection.
- E. Submit Label Certificate FC-1, Figure 3-3, from the Nonresidential Compliance Manual documenting compliance with the CBC, California Building Code, (CCR) California Code of Regulations, Title 24, Part 6, Section 116, Table 116-A and 116-8.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect, and handle products under provisions of Section 016200.
- B. Store products on site under cover.
- C. Place products on at least 4-inch wood sills to prevent rust and damage.
- D. Protect doors and frames with resilient packaging.

1.08 SEQUENCING AND SCHEDULING

- A. Sequence work under the provisions of Section 01 32 13.
- B. Schedule work under the provisions of Section 01 32 13.
- C. Schedule delivery of all doors and frames so as not to delay progress of other trades.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Amweld Building Products, Inc., www.amweld.com.
- B. Curries Mfg. Inc., www.curries.com.
- C. Door Components, Inc., www.doorcomponents.com.
- D. Fleming, www.flemingdoor.com.
- E. Krieger Steel Products Company, www.kriegersteel.com.
- F. Republic Builders Products Corporation, www.republicdoor.com.

- G. Curries, www.curries.com.
- H. Ceco, www.cecodoor.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIALS

A. Doors, Panels and Frames

1. Steel: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to A60 or G60 coating class or Type 8, A40 (ZF120) according to ASTM A924 with minimized spangle, mill phosphatized.
2. Exterior Doors: ANSI A250.8, Level 3, extra heavy-duty, Model 2, continuous welded seam, minimum 0.053-inch-thick faces (16 GA. Minimum).
3. Interior Doors: ANSI A250.8, Level 2 heavy duty, Model 1, minimum 0.042-inch-thick faces (18 GA. Minimum).
4. Exterior Frames: ANSI A250 .8, Level 3, 0.067-inch-thick material (14 GA. Minimum), core thickness.
5. Interior Frames: ANSI A250 .8, Level 2, 0.053-inch-thick material (16 GA. Minimum), core thickness.
6. Panels: Same materials and construction as specified for doors.

B. Door Core

1. Exterior Core: Polystyrene insulation.
2. Interior Door Core: Impregnated cardboard honeycomb.

C. Closer Channels

1. Close top and bottom edge of exterior door flush with inverted steel channel closure. Weld all joints watertight.

D. Frame Anchors

1. Masonry Anchors: Adjustable T-strap, 0.053-inch-thick steel, corrugated, 2-inch x 10-inch size. Fire rated frames to have UL listed perforated strap anchor permanently anchored to frame.
2. Metal Stud Anchor: Z type anchor, welded to frame, 0.053-inch-thick steel, UL listed as required for fire rating.
3. Wood Stud Anchor: U shaped anchor, welded to frame, 1 inch wide, 0.053-inch-thick steel, with 2 pre-punched holes in nailing flange. UL listed as required for fire rating.
4. Existing Wall Anchor: 0.053-inch-thick pipe spacer with 2-inch x 0.053-inch-thick steel plate sized to accommodate a 3/8 diameter countersunk flathead expansion anchor. UL listed as required for fire rating.
5. Floor Clip: Angle anchor, full width of frame, 0.067-inch-thick steel.

E. Protective Coatings

1. Bituminous Coating: Fibered asphalt-based corrosion proofing and sound deadener compound. Equivalent to Transcoat 101-F, www.oilservice.com.
2. Primer: Clean and treat with three stage iron phosphate process. Provide baked-on shop coat of EPA compliant gray synthetic rust - inhibitive enamel primer meeting acceptance criteria of ANSI 250.10.

F. Hardware Reinforcement

1. Fabricate frames and doors with hardware reinforcement plates welded in place.
2. Hinge reinforcing shall be full width of frame profile.
3. Provide spacers for all thru-bolted hardware.
4. Reinforcement components shall be the following minimum thickness:
5. Hinge (door and frame) 3/16 inch
6. Mortise Lock or Deadbolt 0.093 inch
7. Bored Lock or Deadbolt 0.093 inch
8. Flush Bolt Front 0.093 inch
9. Surface Bolt 0.093 inch
10. Surface Applied Closer 0.093 inch
11. Hold Open Arm 0.093 inch
12. Pull Plates and Bars 0.067 inch
13. Surface Exit Device 0.093 inch
14. Floor Checking Hinge 0.167 inch
15. Pivot Hinge 0.167 inch

2.03 ACCESSORIES

- A. Door Louvers: 18-gauge, non-vision, inverted split "Y louver with 12-gauge security grille two sides, prime coat finish for field painting. Provide optional galvanized attached mesh insect screen. Size as shown on Drawings.
 1. Anemostat security door louvers, model #PLSL.
 2. Air Louvers Inc., Model 1500-A.
- B. PeepHoles: Schlage 190 Degree Wide Angle Viewer. Satin nickel finish.
- C. Rubber Silencers: Resilient rubber as supplied by Section 08 71 00.
- D. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws at door installations, square butt at light frames.

2.03 FABRICATION

- A. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing.
- B. All spliced joints shall occur on the interior side of exterior frames.

- C. Fabricate frames as full profile welded units.
- D. All face, rabbet and soffit joints between abutting members shall be continuously welded and finished smooth when exposed to exterior.
- E. Corner joints shall have all contact edges closed tight, with faces mitered and continuously welded.
- F. Frames with multiple openings shall have mullion members fabricated with no visible seams or joints. All face, rabbet and soffit joints between abutted members shall be continuously welded and finished smooth when exposed to exterior.
- G. Provide 3/8-inch back bend return on frames where gypsum board wall material occurs whether on one or both sides.
- H. Mullions for Double Doors: Removable type supplied by Section 08 71 00.
- I. Dust cover boxes or mortar guards of 0.016-inch-thick steel shall be provided at all hardware mortises on frames.
- J. Reinforce frames wider than 48 inches with roll formed, 0.093-inch-thick steel channels fitted tightly and welded into frame head, inverted U-shape profile.
- K. Prepare frame for silencers except for frames which receive weatherstripping. Provide three (3) single rubber silencers for single doors on strike side, and two (2) single silencers on frame head at double doors without mullions.
- L. Provide steel spreader temporarily attached to feet of both jambs as a brace during shipping and handling. Spreader is not to be used for installation purposes.
- M. Attach fire rated label to each frame and door unit.
- O. Manufacturing Tolerances
 - 1. Manufacturing tolerance shall be maintained within the following limits:
 - 2. Frame width +1/16 inch -1/32 inch
 - 3. Frame height +3/64 inch
 - 4. Frame face +1/32 inch
 - 5. Frame stop +1/32 inch
 - 6. Frame rabbet +1/64 inch
 - 7. Frame depth +1/32 inch
 - 8. Frame throat +1/16 inch
 - 9. Door width and height +3/64 inch
 - 10. Door thickness +1/16 inch
 - 11. Hardware location +1/32 inch
 - 12. Door flatness +1/16 inch

2.4 FINISHES

- A. Primer: Baked on rust-inhibitive enamel.
- B. Finish: Site paint under provisions of Section 09 91 00.
- C. Coat inside of frame profile for frames installed in masonry construction with bituminous coating to a thickness of 1/16 inch. Coating may be factory or site applied. Do not apply coating to fire rated frames.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.
- C. Install fire doors and frames in accordance with NFPA 80.
- D. Installation of exterior doors and frames to be weathertight and waterproof.
- E. Seal penetration of all surface applied screws on exterior face of frames at glass stops and hardware attachments.
- F. Coordinate with wall construction and details for anchor placement. Provide anchors as follows:
- G. Frames up to 7 feet 6 inches height - 4 anchors each jamb.
- H. Frames 7 feet 6 inches to 8 feet 0-inch height - 5 anchors each jamb, plus an additional anchor for each 2 feet or fraction thereof over 8 feet 0 inch.
- I. Frames for double doors; minimum of two (2) anchors in head approximately 12 inches from each jamb.
- J. Borrowed lite frames; two (2) anchors each jamb plus 1 for each 18 inches or fraction thereof over 3 feet 0 inch. Minimum two (2) anchors in head and sill approximately 12 inches from each jamb plus 1 for each 30 inches of length or fraction thereof.
- K. Floor anchors - one (1) anchor each jamb for interior doors. Where wall construction will not allow placement of floor anchor, provide one (1) additional jamb anchor as close to floor as possible.
- L. Existing wall anchors shall be welded to provide non-removable condition. Welded bolt head to be ground, dressed and finished smooth.
- M. Frames installed in masonry walls to be fully grouted with masonry grout.

- N. Exposed field welds to be finished smooth and touched up.
- O. Primed or painted surfaces which are scratched or marred shall be touched up.
- P. Hardware to be applied in accordance with hardware manufacturer's templates and instructions.
- Q. Coordinate installation of glass and glazing.
- R. Install door louvers.
- S. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.02 CONSTRUCTION

A. INSTALLATION TOLERANCES

1. Edge clearance for swinging doors shall not exceed the following:
 - a. Between door and frame at head and jamb: 1/8 inch.
 - b. Between edge of pair of doors: 1/8 inch.
 - c. At door sill with threshold. (From bottom of door to top of threshold): 3/8 inch.
 - d. At door sill with no threshold: 1/2 inch.
 - e. At door bottom and rigid floor covering per NFPA 80: 1/2 inch.
 - f. At door bottom and nominal floor covering per NFPA 80: 5/8 inch.
2. Frame installation tolerance shall not exceed the following:
 - a. Squareness $\pm 1/16$ inch.
 - b. Alignment $\pm 1/16$ inch.
 - c. Plumbness $\pm 1/16$ inch.
 - d. Diagonal Distortion $\pm 1/32$ inch.

END OF SECTION

SECTION 08 14 00

WOOD DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Flush faced wood doors and panels, fire rated, and non-rated.
3. Door louvers.

B. Referenced Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 11 00 - Metal Doors and Frames (for frame construction).
3. Section 08 71 00 - Door Hardware.
4. Section 08 80 00 - Glazing.

1.02 REFERENCES

- A. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2.
- B. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.
- C. NWWDA I.S.1 - Industry Standard for Wood Flush Doors (Includes Standards I.S.1.1 through I.S.1.7).
- D. FSC - Forest Stewardship Council.
- E. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies.
- F. WI - Woodwork Institute: Manual of Millwork.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of WI Manual of Millwork, Section 12 and 13, Custom Grade except where otherwise indicated.
- B. All wood doors and the installation of wood doors shall be monitored for compliance under the scope of the WI Certified Compliance Program (CCP).
- C. Issue a WI Certified Compliance Certificate prior to delivery of doors certifying that doors meet all requirements of WI Grade specified.

D. After completion issue a WI Certified Compliance Certificate for Installation.

E. Regulatory Requirements:

1. Conform to CBC - California Building Code, for fire rated doors and panels.
2. Fire Door and Panel Construction: Conform to UL 10C, Category A.
3. Installed Doors and Panels: Conform to NFPA 80 for fire rated class indicated.

1.05 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00. Shop drawings shall bear the WI Certified Compliance Label on the first page of each set.
- B. Indicate door elevations, stile and rail reinforcement, internal blocking for hardware attachment, and cutouts for glazing and louvers.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two (2) samples 12 by 12 inch in size illustrating each species.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of Section 01 62 00.
- B. Package, deliver, and store doors in accordance with WI requirements as set forth in Technical Bulletin 419-R.

1.07 WARRANTY

- A. Provide manufacturer's standard lifetime warranty for interior doors and five (5) year warranty for exterior doors under provisions of Section 01 78 36 for solid core doors.
- B. Provide five (5) year manufacturer's warranty under provisions of Section 01 78 36 for Stile and Rail Doors.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. FLUSH FACED DOORS

1. Graham, www.grahamdoors.com.
2. Algoma Hardwoods, www.algomahardwoods.com.
3. Buell Door Co., www.buelldoor.com.
4. Eggers Industries, www.eggersindustries.com.
5. Oshkosh Door Co., www.oshkoshdoor.com.

6. Marshfield Door Systems, Inc., www.marshfielddoors.com.
7. V.T. Industries, www.vtindustries.com.
8. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIALS

A. Door And Panel

1. Solid Non-Rated Core: Solid wood block, framed block glued, or solid particleboard.
2. Solid, Special Function Core: Labeled fire performance type, UL 10C, Category A. intumescent seals concealed by outer stile in matching veneer.
3. Construction: WI, custom grade, 5 ply, manufactured as an edge bonded, sanded core assembly, laminated in a one-step, hot pressed operation. Cold-press method is not acceptable.
4. Panels: WI Type 1.
5. Flush Interior Door Veneer: Birch species; plain sliced with book matched grain, for transparent stain finish. Satin sheen. Factory finish. Color as selected.
6. Wood materials shall be Forest Stewardship Council (FSC) certified.
7. Composite wood shall be free of added urea formaldehyde.

B. Adhesives

1. Exterior Doors: WI Type I.
2. Interior Doors: WI Type I.

2.03 ACCESSORIES

- A. Door Louvers: 18-gauge, non-vision, inverted split "Y louver with 12-gauge security grille two sides, prime coat finish for field painting. Provide optional galvanized attached mesh insect screen. Size as shown on Drawings.
 1. Anemostat security door louvers, model #PLSL.
 2. Air Louvers Inc., Model 1500-A.
- B. PeepHoles: Schlage 190 Degree Wide Angle Viewer. Satin nickel finish.
- C. Rubber Silencers: Resilient rubber as supplied by Section 08 71 00.

2.04 FABRICATION

- A. Fabricate non-rated wood doors to requirements of WI Manual of Millwork, Section 12 or 13, in the WI Grade specified.
- B. Fabricate fire rated doors per manufacturer's standard construction, and labeling agency requirements.
- C. Pre-machine doors for finish hardware.

- D. For fire rated doors with mineral cores, provide solid wood blocks for hardware reinforcement at lock edge and at top of door for closer.
- E. For fire rated doors with mineral cores, provide solid wood blocking for thru-bolted hardware.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install doors in accordance with WI Manual of Millwork Sections 12 and 13 and WI Technical Bulletin 420-R.
- B. Conform to WI and NFPA requirements for fit tolerances.
- C. Coordinate installation of glass and glazing.
- D. Install door louvers.
- E. Adjust doors for smooth and balanced movements.
- F. Install fire doors in accordance with NFPA 80.

G. INSTALLATION TOLERANCES

1. Edge clearance for swinging doors shall not exceed the following as required by WI and NFPA 80:

a. Between door and frame at head and jamb	1/8 inch
b. Between edge of pair of doors	1/8 inch
c. Diagonal distortion	1/8 inch
d. At door sill with threshold. (From bottom of door to top of threshold)	3/8 inch
e. At door sill with no threshold	1/2 inch
f. At door bottom and rigid floor covering per NFPA 80	1/2 inch
g. At door bottom and nominal floor covering per NFPA 80	5/8 inch

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel access panels, except those specified under Divisions 22 - Plumbing, 23 - HVAC, or 26 - Electrical.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 06 10 00 - Rough Carpentry.
3. Section 09 29 00 - Gypsum Board.
4. Section 09 30 00 - Ceramic Tiling.
5. Section 09 91 00 - Painting and Coating.
6. Division 22 - Plumbing.
7. Division 23 - HVAC.
8. Division 26 - Electrical.
9. Division 27 - Communications.

1.02 SUBMITTALS

A. Shop Drawings:

- B. Indicate sizes, materials, thickness, fabrication methods, panel door and frame reinforcement, anchorage, and installation details.
- C. Provide layout drawings, indicating dimensioned locations of proposed access panels, size of each panel, and installation details. Determine and indicate required access panels in finished surfaces, whether furnished under this section or as part of Work of Divisions 22-Plumbing, 23- HVAC, and 26-Electrical.

1.03 QUALITY ASSURANCE

- A. Panels shall be provided with UL listings and labels.
- B. Access panels and frames shall be products of one (1) manufacturer.
- C. Coordinate access panels with plumbing, HVAC, and electrical work.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Panels and Frames: Provide protection as required by manufacturer to protect panels from damage during storage.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Access Panels:

<u>Non-Rated</u>	<u>Milcor</u>	<u>Karp</u>	<u>Nystrom</u>
Ceramic Tile	MS	DSC214M	NT
Plaster	K	DSC214M	NP
Drywall, Plaster Veneer	DW	DSC214M	NW
<u>Fire Rated</u>			
Ceramic Tile	MS	KRP150FR	IT
Plaster	M	KRP150PR	IP
Drywall, Plaster Veneer	M	KRP150FR	IW

- B. Or approved equal.
- C. Unless otherwise indicated, provide brushed stainless-steel finish for panels installed in ceramic tile. Provide prime coat finish suitable for field painting for panels installed in other finishes.
- D. Access Panels shall be 18 gauge minimum with vandal-proof lock operated by Allen wrench or another special tool. Exposed fastenings shall be secured with vandal-proof screws.
- E. Ceiling Access Doors.
1. Provide exterior type single-door by Dur-Red Products, Model TCA, 30 inches by 36 inches in size.
 - a. Door Leaf: 1-inch-thick core rigid fiberglass with 20-gauge steel outer shell.
 - b. Finish: Primer grey and painted minimum two (2) coats of paint. Color to match adjacent ceiling color finish.
 2. Install ceiling access door where access to the enclosed attic spaces is required and/or as shown in the drawings. If not shown in the drawings, provide one ceiling access panel in each enclosed drywall ceiling room. Where ceiling is rated, the ceiling access door shall meet or exceed the rating of the ceiling. All ceiling access doors shall receive keyed locks.

PART 3 – EXECUTION

3.01 GENERAL

- A. Provide access panels in finish construction, where indicated on Drawings, wherever required for access to concealed mechanical and electrical equipment, and where required by codes. Panels indicated on architectural Drawings shall be furnished under this section. Required panels for access to equipment, but not indicated on architectural Drawings, shall be furnished as part of Work requiring access.

3.02 INSTALLATION

- C. Install panels accurately in location, perfect alignment, plumb, straight and true. Brace to prevent displacement by adjacent Work.
- B. Examine panels after installation for proper opening, closing and clearances. Replace damaged or defective panels.

3.03 CLEANING

- A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

3.04 PROTECTION

- A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following, but is not necessarily limited to:
 - 1. Door Hardware, including electric hardware.
 - 2. Storefront and Entrance door hardware.
 - 3. Gate Hardware.
 - 4. Digital keypad access control devices.
 - 5. Thresholds, gasketing and weather-stripping.
 - 6. Door silencers or mutes.
- C. Related Sections:
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Section 08 11 00 – Metal Doors and Frames.
 - 3. Section 08 14 00 – Wood Doors and Frames.
 - 6. Section 32 31 13 – Chain Link Fences.
 - 7. Section 32 31 19 – Decorative Metal Fences and Gates (for hinge/closer units).
- D. Related Documents
 - 1. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. 2016 California Building Code, CCR, Title 24.
- B. BHMA – Builders’ Hardware Manufacturers Association
- C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. DHI – Door and Hardware Institute
- E. NFPA - National Fire Protection Association.

1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
 2. NFPA 105 – Standard for Smoke Door Assemblies and Other Opening Protectives
- F. UL - Underwriters Laboratories.
1. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies
 2. UL 305 – Standard for Panic Hardware
- G. WHI - Warnock Hersey Incorporated
- H. SDI - Steel Door Institute

1.03 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit six (6) copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
1. Include a Cover Sheet with;
 - a. Job Name, location, telephone number.
 - b. Architects name, location and telephone number.
 - c. Contractor's name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.
 - e. Hardware consultant's name, location and telephone number.
 2. Job Index information included;
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.
 3. Vertical schedule format sample:
 - a. Single or pair with opening number and location.
 - b. Degree of opening

- c. Hand of door(s)
 - d. Door and frame dimensions and door thickness.
 - e. Label requirements if any.
 - f. Door by frame material.
 - g. (Optional) Hardware item line #.
 - h. Keypad Symbol.
 - i. Quantity.
 - j. Product description.
 - k. Product Number.
 - l. Fastenings and other pertinent information.
 - m. Hardware finish codes per ANSI A156.18.
 - n. Manufacture abbreviation.
- D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.
- F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.
- J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.04 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that

- employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
1. Responsible for detailing, scheduling and ordering of finish hardware.
 2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing. To maintain the integrity of patented key systems, provide a letter of authorization from the specified manufacturer indicating that supplier has authorization to purchase the key system directly from the manufacturer.
 3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.
- G. Pre-Installation Conference
1. Schedule a pre-installation conference at least one week prior to beginning work of this section.
 2. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key Owner Personnel, and Project Inspector.
 3. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review Owner's keying standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.06 WARRANTY

- A. Provide warranties of respective manufacturers’ regular terms of sale from day of final acceptance as follows:
 - 1. Locksets: “L” Series (3) years – “ND” Ten (10) years.
 - 2. Electronic: One (1) year.
 - 3. Closers: Thirty (30) years –1260 twenty (20) years –Concealed High Security fifteen (15) years except electronic closers shall be two (2) years.
 - 4. Exit devices: Three (3) years.
 - 5. All other hardware: Two (2) years.

1.07 MAINTENANCE

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Dust Proof Strikes	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI

Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.02 MATERIALS

A. Hinges: Ives as scheduled.

1. Ives5BB1HW x NRP (Heavy use exterior doors) 630 finish.
Ives 5BB1HW (Interior doors) 652 finish.
2. Hinges shall be sized in accordance with the following:
 - a. Height:
 - 1) Doors up to 42" wide: 4-1/2" inches.
 - 2) Doors 43" to 48" wide: 5 inches.
 - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
3. Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Continuous Hinges: Ives as scheduled.

1. SL-224HD (Heavy use exterior doors & Remodels) 628 finish.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.

1. Bathroom (Student – multi use) ND94
2. Faculty ND94
3. Administration ND91
4. Communicating ND72VandlegardXN12-003
5. Classroom Safe School Lock ND95
6. Bathroom (Typical) ND94
7. Janitor / Storage room ND96
8. Bathroom (Faculty - single compartment toilet) L9485 x 06A x L283-722
9. Bathroom (Faculty and Student please consult)

10. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Offset lever pull – minimum 1,600-foot pounds without gaining access
 - c. Vertical lever impact – minimum 100 impacts without gaining access
 11. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
 12. Cylinders: Refer to “KEYING” article, herein.
 13. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
 14. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
 15. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 16. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 17. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 18. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
- D. Exit devices: Von Duprin as scheduled.
1. CD98NL-AX x 990NL (Single Door) 626 finish
 2. CD98NL-AX x CD98DT x KR4954 Mullion x 154 (Pairs) 626 finish
 3. 98L-AX-2-F-996L (F Rated Single Door) 626 finish
 4. 98L-AX-2-F-996L x 2 KR9954 Mullion 154(F Rated Pairs) 626 finish
 - a. No vertical rods allowed.
 - b. Use -2 Function to meet AB 211
 - c. MT54 Mullion Storage at Pairs
 5. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
 6. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
 5. Non-handed basic device design with center case interchangeable with all functions.
 6. All devices shall have quiet return fluid dampeners.
 7. All latch bolts shall be deadlocking with ¾” throw and have a self-lubricating coating to reduce friction and wear.
 8. Device shall bear UL label for fire and or panic as may be required.
 9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
 10. Lever Trim: “Breakaway” design, forged brass or bronze escutcheon with a minimum of .130” thickness, match lockset lever design.
 11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
 - a. MT54 Mullion Storage at Pairs
 12. Furnish glass bead kits for vision lites where required.
 13. All Exit Devices to be sex-bolted to the doors.
 14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34” and 44” above the finished floor surface.

- a. The unlatching force shall not exceed 15 lbs. applied in the direction of travel.
- OR-
- b. Provide exit devices UL certified to meet maximum 5-pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.
- E. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
1. P4041XP 689 finish
 - a. Hold open arms or cushion closers are not allowed.
 2. Door closer cylinders shall be of high strength cast iron construction with double heat-treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
 3. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
 4. All parallel arm closers shall incorporate one-piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
 5. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
 6. Closers shall be installed to permit doors to swing 180 degrees.
 7. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
 8. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed. Door frames shall be reinforced at all mounting locations.
 9. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. Per 11B- 404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.
- F. Flush Bolts & Dust Proof Strikes: Ives as scheduled.
1. FB51 (Manual) (metal doors) (Storage & Utility rooms) 626 finish
 2. FB61P (Manual) (wood doors) (Storage & Utility rooms) 626 finish

- a. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
- b. Provide dust proof strikes at openings using bottom bolts.
- c. Automatic flush bolts allowed only where required by Fire Code.

G. Door Stops: Ives as scheduled.

1. FS18S (Exterior Floor) 626 finish
2. FS 436/438 (Interior Floor) 626 finish
3. WS 406CVX (Wall) 626 finish
4. WS406CCV (Inswing push-button locks) 626 finish
 - a. Allow for maximum swing of doors
 - b. Backing required at wall holders
5. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
6. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
7. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

H. Door Holders: Ives as scheduled.

1. WS452-4 Series Automatic Holder (Door) 626 finish
2. FS40 Series Automatic Holder (Wall) 626 finish
 - a. Backing required at wall holders
 - b. Allow for maximum door swing

I. Protection Plates: Ives as scheduled.

1. Kick Plate: 8400-10" x 2" LDW 630 finish
2. Mop Plate: 8400-5" x 2" LDW 630 finish
3. Push / Pull Plate: 8200 x 8302-6x 4x16 630 finish
4. Lock Protector: LP-13, LP-12 626 finish
5. Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

J. Thresholds: As Scheduled and per details.

1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection".
3. Use ¼" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
4. Thresholds shall comply with CBC Section 11B-404.2.5.

K. Seals and Surface Applied Hardware: Zero as scheduled.

1. Smoke Seal:488S-BK Black
 2. Weather Seal: 488S-BK 628 finish
- and-
- 8780N Factory
 3. Door Sweep: 328AA 689 finish
 - 4 139SS (Wood doors) (Use only where required by fire code) 630
 - a. Astragal by door manufacturer at HM door
 5. Drip Guard: 17D x 4" PDW (Exterior doors exposed to rain) 628
 6. Door Bottom: Use automatic door bottoms only if required by code.
 7. Provide silicone gasket at all rated and exterior doors.
 8. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 9. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
 10. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.
- L. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- M. Silencers: Ives as scheduled.
1. 654A, 655A, 623A Black
 2. Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.
- N. Keying: Schlage as scheduled.
1. Furnish a Proprietary Schlage master key system as directed by the owner or architect. Key system to be designated and combination-d by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer. This is to be a Schlage Primus keying system. SCUSD to verify all keyways. Provide as follows:
 - a. 6 pin x Standard Core plug (D Series) 626 finish
 - b. 6 pin x Rim type x IC Core (Exit Device) 626 finish
 - c. 6 pin x 1-1/4" Mortise x IC Core (KR Mullions and CD) 626 finish
 2. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.
 3. Establish a new master key system for this project as directed by the keying schedule.
 4. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).

5. Furnish PrimusXP "Classic" keyway Patent Protected Schlage cylinders where noted. Furnish all other cylinders in matching conventional "Classic" keyway. Furnish Patent Protected Schlage keys for all cylinders. (e.g., Primus XP Classic Keyway for patent protected / Maximum control) (with mix of conventional "Classic" keyway)
6. Furnish construction keying for doors requiring locking during construction.
 - a. For FSIC systems provide 23-030-ICX Full Size Construction Cores
 - b. For FSIC systems provide ten 48-101-ICX Construction Keys
 - c. For FSIC systems provide two 48-056-ICX Control Keys (const.)
 - d. For FSIC systems provide two control keys for installing the permanent cores (49- 056 for "Classic" keyways, 48-052-XP for "Classic Primus") (49-003 for "Everest Conventional", 48-005-XP for "Everest Primus")

-OR-

7. Furnish construction keying for doors requiring locking during construction.
 - a. For "Split Key" Construction Cylinders (non-IC cylinders) specify "CK" for each keyed cylinder.
 - b. Provide ten Construction Keys (48-104 "Classic", 48-008 "Everest")
 - c. Provide two Extractor Tools (35-057)
8. Furnish all keys with visual key control.
 - a. Stamp key "Do Not Duplicate".
9. Furnish mechanical keys as follows:
 - a. Furnish 2 cut change keys for each different change key code.
 - b. Furnish 1 uncut key blank for each change key code.
 - c. Furnish 6 cut master keys for each different master key set.
 - d. Furnish 3 uncut key blanks for each master key set.
 - e. Furnish 2 cut control keys cut to the top master key for permanent I/C cylinders.
 - f. Furnish 1 cut control key cut to each SKD combination.
 - g. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47- 413 (conventional) or 47-743-XP (PrimusXP) with above.
 - h. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
 - i. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.
10. Furnish Schlage Padlocks and the cylinders to tie them into the master key system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
 - a. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47- 413 (conventional) or 47-743-XP (PrimusXP) with above.
 - b. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
 - c. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.

O. Fasteners

1. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
2. Screws for butt hinges shall be flathead, countersunk, full-thread type.
3. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
4. Provide expansion anchors for attaching hardware items to concrete or masonry.
5. All exposed fasteners shall have a Phillips head.
6. Finish of exposed screws to match surface finish of hardware or other adjacent work.
7. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

2.04 FINISHES

- A. Generally, to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.
- C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
- I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
- J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
- K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
- L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer's technical documentation.
- J. Hardware Locations
 - 1. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.03 ADJUSTING AND CLEANING

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions 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.

3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

- A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
- B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
LCN	=	LCN	Door Closers

SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HARDWARE GROUP NO. S01 – EXTERIOR SITE SINGLE GATE (no access control)
GATE NUMBERS – G01, G02, G03, G04, G08

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	HINGE/CLOSER	SEE 32 31 19	--	--
1 EA	PANIC	AX-CD-98-NL	626	VON
1 EA	PANIC	AX-CD-98-EO	626	VON
2 EA	PRIMUS CORE	20-740-XP	626	SCH
1 EA	FLOOR STOP	FS18S	BLK	IVE

HARDWARE GROUP NO. E01 - EXTERIOR SINGLE LEAF OUTSWINGING TOILET ROOM DOOR
DOOR NUMBERS - B100, B101, C100, C101

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	224XY	628	IVE
1 EA	LOCKSET	ND94LD RHO	626	SCH
1 EA	PRIMUS K-I-L CYL.	20-765-XP	626	SCH
1 EA	SURFACE CLOSER	4040XP	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1 EA	WALL STOP	FS40 SERIES	626	IVE
1 EA	GASKETING	488SBK PSA	BK	ZER
1 EA	DOOR SWEEP	111AA	AA	ZER
1 EA	THRESHOLD	1545	AL	ZER

HARDWARE GROUP NO. E02 - EXTERIOR SINGLE LEAF OUTSWINGING STORAGE ROOM DOOR
DOOR NUMBERS - B102

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	224XY	628	IVE
1 EA	LOCKSET	ND96LD RHO	626	SCH
1 EA	PRIMUS K-I-L CYL.	20-765-XP	626	SCH
1 EA	SURFACE CLOSER	4040XP	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1 EA	WALL STOP	FS40 SERIES	626	IVE
1 EA	GASKETING	488SBK PSA	BK	ZER
1 EA	DOOR SWEEP	111AA	AA	ZER
1 EA	THRESHOLD	1545	AL	ZER

**HARDWARE GROUP NO. E03 – EXISTING EXTERIOR SINGLE LEAF OUTSWINGING CLASSROOM DOOR
DOOR NUMBERS - XXX**

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	SURFACE CLOSER	4040XP	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1 EA	WALL STOP	FS40 SERIES	626	IVE
1 EA	THRESHOLD	1545	AL	ZER

* DOOR HAS EXISTING RHODES LEVER HARDWARE TO REMAIN*

**HARDWARE GROUP NO. E04 – EXISTING EXTERIOR DOUBLE LEAF OUTSWINGING ENTRANCE DOOR
DOOR NUMBERS - A100, A110**

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2 EA	SURFACE CLOSER	4040XP	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1 EA	WALL STOP	FS40 SERIES	626	IVE

* DOOR HAS EXISTING VON DURPIN 98 SERIES PANIC HARDWARE WITH EXTERIOR PULL TO REMAIN*

**HARDWARE GROUP NO. E05 – NEW SINGLE STAFF TOILET DOOR
DOOR NUMBERS - A110, C104**

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	224XY	628	IVE
1 EA	LOCKSET	ND85 RHO	626	SCH
1 EA	PRIMUS K-I-L CYL.	20-765-XP	626	SCH
1 EA	SURFACE CLOSER	4040XP	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1 EA	WALL STOP	FS40 SERIES	626	IVE

**HARDWARE GROUP NO. E06 – NEW SINGLE CLASSROOM DOOR
DOOR NUMBERS - A119A, C105A**

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	224XY	628	IVE
1 EA	LOCKSET	ND98 RHO	626	SCH
2 EA	PRIMUS K-I-L CYL.	20-765-XP	626	SCH
1 EA	SURFACE CLOSER	4040XP	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1 EA	WALL STOP	FS40 SERIES	626	IVE

**HARDWARE GROUP NO. I01 – NEW SINGLE TOILET ROOM DOOR
DOOR NUMBERS - B105**

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	LOCKSET	ND10 RHO	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS TKTX	630	IVE
1	EA	WALL STOP	FS40 SERIES	626	IVE

END OF SECTION

**SECTION 08 80 00
GLAZING**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Glass and glazing for storefronts, curtain walls, windows, and doors.
- B. Applied custom graphic window film.

1.02 RELATED SECTIONS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Section 07 90 00: Joint Sealers: Sealant and back-up material.
- C. Section 08 11 00: Metal Doors and Frames.

1.03 REFERENCES

- A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- B. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
- C. ASTM C920 - Elastomeric Joint Sealants.
- D. ASTM C1036 - Flat Glass.
- E. ASTM C1048 - Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D2240 - Test Method for Rubber Property - Durometer Hardness.
- H. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- I. ASTM C 1048 – Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
- J. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

1.04 SUBMITTALS

- A. Submit under provisions of Section 00 72 00.
- B. Product Data on Glass Types Specified: Provide structural, physical and environmental

characteristics, size limitations, special handling or installation requirements.

- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special handling or installation requirements. Identify available colors.
- D. Samples: Submit two samples, 12x12 inch in size, illustrating glass.
- E. Samples: Submit 3 inch long bead of glazing sealant, color as selected.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual for glazing installation methods.
- B. Installer's Qualifications: The installation shall be performed only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics who specialize in glazing and glass installation.
- C. Safety glazing shall be identified in accordance with Section 2406.3, 2022 CBC, Title 24, Part 2 with identification etched in glass.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 48 hours after installation of glazing compounds.

1.07 FIELD MEASUREMENTS

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

1.08 COORDINATION

- A. Coordinate Work with glazing frames, wall openings, and adjacent Work.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All Glass shall be graded and meet requirements of ASTM C1036. Each light of glass delivered and installed shall have affixed thereto the manufacturer's grade label.

2.02 GLASS TYPES

- A. **Type 1/4CT:** Clear Tempered Glass; ASTM C1048-85, Type 1, Class 1, Quality q3. Heat strengthened by manufacturer's standard process (after cutting to final size) to achieve a flexural strength 4 times normal glass strength; 1/4" thickness. All tempered glass shall have a permanent logo signifying compliance with the Consumer Product Safety Commission 16 CFR 1201 C1 and C11.
- B. **Type 1/4FT:** Frosted Tempered Glass; ASTM C1048-85, Type 1, Class 1, Quality q3. Heat strengthened by manufacturer's standard process (after cutting to final size) to achieve a flexural strength 4 times normal glass strength; 1/4" thickness. All tempered glass shall have a permanent logo signifying compliance with the Consumer Product Safety Commission 16 CFR 1201 C1 and C11.

2.03 GLAZING COMPOUNDS

- A. Glazing Sealants (non-sag type): Dow Corning 795, Tremco "Proglaze" or GE Silicone Sealants; Tremco "Mono" acrylic sealant.
- B. Glazing Compound: Shall meet requirements of ASTM C669-00.

2.04 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene EPDM blocks with a Shore A durometer hardness of 85, plus or minus 5 percent, chemically compatible with sealant used.
- B. Spacer Shims: Neoprene, 50-60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 - 15 Shore A durometer hardness; coiled on release paper; black color; Tremco No. 440 tape.
- D. Glazing Splines: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; black color.
- E. Miscellaneous: Furnish all primers-sealers, setting blocks, shims, spacers, compression seals, etc., as required for a first class workmanlike job.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify prepared openings for adequacy to receive glass.
- B. Verify that openings for glazing are correctly sized and within tolerance.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

- D. Report in writing to, any conditions that may be detrimental to the Work.
- E. Only laminated glass lites are to be installed in metal doors.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Check that glass is free of edge damage or face imperfections.

3.03 INSTALLATION

- A. General: Install glass types at locations indicated, according to glass manufacturer's recommendations and as specified herein.
- B. Glass Glazing:
 - 1. Positioning Glass: Orient pattern and draw of glass pieces in same direction. Set all sheet glass so that any waves, etc. are horizontal.
 - 2. Do not cut, nip or abrade tempered glass.
 - 3. Watershed: Gunnable sealants, when applied as a cap head, shall form a bevel or watershed away from the glass. When tape is used to the sightline, it shall form a watershed when compressed. Do not undercut a sealant, compound, or tape below the sightline. Tool and finish sealant as required. Use tooling solution recommended by the sealant manufacturer.
 - 4. Positive Contact:
 - a. When applying a heel bead, lap onto the glass a minimum of 3/16".
 - b. When applying a toe bead, whether continuous or a corner seal, make certain it is large enough to contact both the glass and sash. Install the sealant prior to glass placement.
 - 5. Setting blocks shall be 1/16" less than the full rabbet width, minimum length of 4" and high enough to provide the recommended minimum bite and edge clearance for the glass. Center blocks at 1/4 points unless otherwise recommended by the glass manufacturer.
 - 6. Provide spacer-shims at a maximum of 24" o.c.
 - 7. Clearances: Observe minimum face clearances, edge clearance and glass bite as recommended by the glass and sealant manufacturer.
 - 8. Tape Installation: Do not install glazing tapes more than one day ahead of glass placement. Remove the paper backing from the tape only when the lite is ready to be installed. Do not stretch the tape to make it fit. Do not overlap the ends of the tape. Instead, butt ends together, and when corners are butted together, daub with sealant

to assure a positive seal.

9. Glazing tapes must be kept under proper compression.
10. Glazing stops shall be installed so that stop or frame does not bear directly against glass.

3.04 CLEANING

- A. Clean work under provisions of 00 72 00.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after work is complete.
- D. Clean glass.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 00 72 00.
- B. Replacement: At completion of building construction and prior to its acceptance, all broken, cracked, excessively scratched, or otherwise imperfect glazing materials included under this Section shall be replaced with new glazing materials of the type specified, as directed by the Architect, and at no additional cost to the Owner.

END OF SECTION

SECTION 09 22 00

METAL LATH AND PORTLAND CEMENT PLASTER

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Metal furring and lathing.
- B. Three-coat Portland cement plaster system with integral color stucco finish coat.
- C. Patching of interior plaster, with smooth finish coat.

1.02 RELATED SECTIONS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Section 09 91 00: Painting.

1.03 REFERENCES

- A. ANSI/ASTM C1063-16c - Installation of Lathing and Furring to Receive Interior and Exterior for Portland Cement-Based Plaster.
- B. ANSI/ASTM C91 / C91M-12 - Masonry Cement.
- C. ASTM C150 / C150M-16e1 - Portland Cement.
- D. ANSI/ASTM C206-14 - Finishing Hydrated Lime.
- E. ASTM C847-14a - Metal Lath.
- F. ANSI/ASTM C897-15 - Aggregate for Job-Mixed Portland Cement-Based Plasters.
- G. ANSI/ASTM C926-16b - Application of Portland Cement-Based Plaster.
- H. FS-UU-B-790 - Building Paper, Vegetable Fiber (kraft, waterproofed, water repellent and fire resistant).

1.04 QUALITY ASSURANCE

- A. Applicator: Company specializing in cement plaster work with five years experience.
- B. Apply cement plaster in accordance with ASTM C926 and CBC Chapter 25.

1.05 SUBMITTALS

- A. Submit product data under provisions of Division 0 & 1.
- B. Provide product data on furring and lathing components, plaster materials, characteristics and limitations of products specified, and plastering accessories.
- C. Submit manufacturer's installation instructions under provisions of Section 00 72 00.
- D. Submit color charts for selection of integral color finish coat from manufacture's standard range of a minimum of twelve colors. (Note that the plaster is also required to be painted under Section 09 91 00).
- E. Submit sample of selected color and texture to match existing finish.
- F. Provide shop drawings of exterior elevations showing all proposed vertical and horizontal expansion joints.

1.06 PRODUCT HANDLING

- A. Delivery, storage, and handling in accordance with provisions of Section 00 72 00.
 - 1. Deliver manufactured products to job site in their original unopened containers with labels intact and legible at the time of use.
 - 2. Do not permit scattering of materials or equipment but use necessary means to always ensure neatness of the site and structure.
 - 3. Perform cleaning of tools and equipment only in the area designated for that purpose.
- B. Protection: Use means necessary to protect lath and plaster materials before, during and after installation and to protect the installed work and materials of other trades.
- C. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Architect and at no additional cost to Owner.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply plaster when substrate or ambient air temperature is less than 50 degrees F. nor more than 90 degrees F. If freezing is expected, do not apply plaster beyond period of day necessary for hydration.
- B. Maintain minimum ambient temperature of 50 degrees F. during and after installation of plaster.
- C. Protect plaster from uneven and excessive evaporation during any weather.

PART 2 – PRODUCTS

2.01 PLASTER MATERIALS

- A. Cement: ASTM C150, Normal - Type I, low alkali; grey color; Portland Cement.
- B. Admixture: PRF Admixture as manufactured by Gibco, Inc.
- C. Aggregate: In accordance with ANSI/ASTM C897-05 (latest edition), except that gradation shall meet the following requirements:

Sieve Size	Percent Retained on each sieve (by weight)	
	Maximum	Minimum
No. 4	0	-
No. 8	10	0
No. 16	40	10
No. 30	65	30
No. 50	90	70
No. 100	100	90-95

- 1. The sand should not have more than 50% retained between any two consecutive sieves nor more than 25% between Nos. 50 and 100 sieves.
- D. Water: Clean, fresh, potable, and free of mineral or organic matter which can affect plaster.
- E. Pre-Mixed Finish Coat (Stucco): Acrylic modified water-repellent Portland cement base with integral color prepared in accordance with specifications of the Finish Coat Manufacturer. Acceptable Manufacturers: Peerless Stucco, La Habra, or approved equal. Texture to match existing. Color as selected by Architect from Manufacturer's standard range of a minimum of twelve colors.
- F. Acrylic Modifier for Finish Coat: as manufactured by Finish Coat Manufacturer.

2.02 FURRING AND LATHING MATERIALS

- A. General: All metal to be galvanized steel or zinc alloy.
- B. Metal Lath: Hot dipped galvanized, ASTM A653 / A653M, G60 coating designation for use over solid substrate. Provide and install self-furring lath and furring nails.
- C. Expanded Metal Lath: ASTM C847.
 - 1. Vertical Walls: Self-furring diamond mesh weighing 3.4 pounds per square yard, attachments every six inches on center at furring points. Insure self-furring ribs have not been collapsed during shipping and installation. Lath must maintain a ¼ inch clearance from substrate.
 - 2. Horizontal Areas: 3.4 lath with supports 16 inches on center or less is preferred or a proprietary woven wire specially made for ceilings or soffits can be used.
- D. Building Paper: FS-UU-B-790, Style 2, Grade D.

- E. Fasteners: Provide types and sizes required in CBC, 2022 Edition, Table 2507.2. Lath on solid substrates to be attached with furring nails.
- F. Metal Accessories: General: Minimum 26-gauge galvanized steel or zinc alloy, perforated or expanded flanges as manufactured by Clark Dietrich, USG, Keene/Metelex or approved equal. Use longest possible length; sized and profiled to suit application. Other special products, shapes and sizes as identified in the drawings.
 - 1. Corner Reinforcement: Clark Dietrich Wire Corner Reinforcement.
 - 2. Casing Beads: Clark Dietrich No. 66N square edge.
 - 3. Expansion Screed: Accordion profile: Clark Dietrich #XJ15 unless special shapes are detailed.
 - 4. Sill Screed: Clark Dietrich No. FHA-7 Foundation sill screed.
 - 5. Soffit Vent Screed: Clark Dietrich, 26 GA., perforated soffit vent of profile indicated.
 - 6. Corner Reinforcement: Cornerite, minimum 1.75-pounds per square yard expanded metal lath with minimum 2-inch legs.
 - 7. Strip Reinforcement: For reinforcing joints of dissimilar materials and diagonal reinforcement at opening corners, minimum 1.75-pounds per square yard.
 - 8. Woven Glass Fiber Fabric:
 - a. 10x10 Leno Woven – Resin Coated Glass, white, 36 inches by 150 feet, Stock #FDW6878-U.
 - b. StoGuard Mech 4.25 inch or 9.5-inch, 5 oz. weight, 150-foot length.
 - 9. Tape: Acrylic adhesive backed oriented polypropylene, 3 inch in width.

2.03 CEMENT PLASTER MIXES

- A. Mix and proportion cement plaster as follows:
 - 1. Scratch coat proportions: One-part Portland cement, 4 parts aggregate and 3-ounce PRF admixture. Provide glass fiber reinforcing fibers equal to Fibermesh 150-e3 as manufactured by Propex in quantities as recommended by manufacturer to control cracking.
 - 2. Brown coat proportions: One-part Portland cement, 5 parts aggregate, and 3 ounces PRF admixture.
- B. Mix only as much plaster as can be used in one hour.
- C. Mix materials dry, to uniform color and consistency, before adding water.

- D. Protect mixtures from frost, contamination, and evaporation.
- E. Do not retemper mixes after initial set has occurred.

2.04 PATCHING MATERIAL

- A. 2" wide self-adhering nylon tape.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Inspect the installed work of other trades and verify that such work is complete to the point work of this section may begin.
- C. Verify that substrates to receive lath shall be straight and true to line within 1/4 in. in 10 ft. to receive the specified plaster thickness. (This verbiage is more in line with what code requirements are.)
- A. Report in writing conditions which might adversely affect the performance of installed lath and plaster to the General Contractor with a copy to the Architect.
- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Protect surfaces near the work of this Section from damage or disfiguration.
- B. Saw cut back all existing plaster, careful not to damage existing building paper, to accommodate 6" lap with new building paper.

3.03 INSTALLATION - LATHING MATERIALS

- A. Install metal plaster bases and accessories in conformance with CBC, 2022 Edition, Section 2507 and ANSI C1063.
- B. Apply two layers of building paper underlayment, weatherlap edges 2 inches minimum horizontal and 6 inches minimum vertical laps. Continue building paper minimum 6 inches around inside and outside corners.
- C. Attach lath to wood supports using nails at maximum six inches on center.
- D. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement. Fasten at perimeter edges only.

- E. Place external angle with mesh at corners. Fasten at outer edges only.
- F. Place strip mesh diagonally at corners of lathed openings. Secure rigidly in place.
- G. Place 4-inch-wide strips of glass fiber mesh over scratch coat centered on point of corner at doors, windows, recesses, and other angular openings in building wall. Extend minimum 8 inches diagonally from point of corner. When this occurs metal strips of lath are not needed.
- H. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- I. Install accessories to lines and levels.
- J. Install expansion screeds over all building joints and at intervals recommended by the Technical Services Information Bureau, and where shown.
- K. Locate exterior control and expansion joints as indicated on drawings but not to exceed 12'-0" o.c. horizontally or vertically.
- L. Attach control and expansion joints to metal lath with wire ties.
- M. Install expansion joint over 3-inch-wide strip of polypropylene tape to assist with air seal continuity.

Cut metal lath behind expansion and control joints. Double studs at all joints. Lath to be nailed on either side of cut lath.

3.04 PLASTERING

- A. General: When complete, plaster surfaces shall be flat, true to plane, free from defects and shall be uniform in texture.
- B. Apply plaster in accordance with ASTM C926.
- C. Apply scratch coat to a nominal thickness of 3/8 inch over metal reinforcement. Cover metal reinforcement.
 - 1. After application, lightly score scratch coat horizontally.
 - 2. If brown coat cannot be applied within 4 hours, keep scratch coat moist for 48 hours.
- D. Apply brown coat to a nominal thickness of 3/8 inch over scratch coat. Rod brown coat straight and true in all directions.
- E. Moist cure brown coat for minimum 14 days. Areas shall be thoroughly moistened by use of a fine mist at a minimum of three times daily and as may be required due to weather conditions, per the Services Information Bureau. recommendations.

3.05 STUCCO FINISH

- A. Dampen brown coat evenly before applying finish coat.
- B. Mix integrally colored manufactured stucco finish with solution of 1-part acrylic modifier and 3 parts water. Use only sufficient solution to produce plastic mortar. Apply entire panels of finish coat without joints with necessary joints occurring at natural breaking points and control joints.
- C. Apply machine applied finish coat approximately 1/8-inch thickness.
- D. Texture: Medium dash coat finish to best match existing.

3.06 STUCCO PATCHING AT WALL CRACKS

- A. Scrape existing finish smooth a minimum of 4" on each side of crack. Acid wash areas stained due to water damage.
- B. Apply nylon tape over full length of crack.
- C. Apply bonding agent over entire area to receive new finish coat of stucco.
- D. Apply stucco finish coat over area, matching existing. Extend evenly into existing wall finish.

3.07 TOLERANCES

- A. Maximum Variation from True Flatness: ¼" in 10 feet, properly meeting adjacent surfaces and materials.

3.08 CLEANING

- A. Remove plaster and protective materials from control and expansion joints, perimeter beads and adjacent surfaces. Remove stains that would adversely affect subsequent finishes on plaster.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Gypsum board.
- B. Taped and sanded joint treatment.
- C. Accessories.

1.02 RELATED WORK

- A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 06 10 00: Rough Carpentry.
- C. Section 07 90 00: Joint Sealants.
- D. Section 08 11 00: Metal Doors and Frames.
- E. Section 09 30 13: Ceramic Tile Work.
- F. Section 09 90 00: Painting.
- H. Section 10 26 23: Fiber Reinforced Laminate (FRL).
- I. Section 10 28 00: Toilet and Bath Accessories.

1.03 REFERENCES

- A. ANSI/ASTM C1396 / C1396M-14a - Gypsum Wallboard.
- B. ANSI/ASTM C514-04(2014) - Nails for the Application of Gypsum Wallboard.
- C. ANSI/ASTM C630/C630M-03 - Water Resistant Gypsum Backing Board.
- D. Gypsum Association GA 216 - Application and Finishing of Gypsum Board Products.
- E. ASTM C645-14e1 - Non-Load Bearing (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- F. ASTM C840-16 - Application and Finishing of Gypsum Board.
- G. ASTM C955-15e1 - Load Bearing (Transverse and Axial) Steel Studs, Runners (Track) and Bracing or Bridging, for Screw Application of Gypsum Board.
- H. ASTM C1002-14 - Steel Drill Screws for the Application of Gypsum Wallboard.
- I. ASTM C1047-14a - Accessories for Gypsum Wallboard and Gypsum Veneer Base.

1.04 QUALITY ASSURANCE

- A. Applicator: Company specializing in gypsum board systems work with minimum five years experience.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver: All materials shall be delivered in original packages or bundles with the manufacturer's labels intact and legible.
- B. Handling and Storage: Materials shall be kept dry, stacked off the ground and properly supported and protected from weather. Protect all edges and surfaces. Stack wallboard flat.

1.06 JOB CONDITIONS

- A. Building Temperature and Ventilation: Do not install wallboard and joint compounds if building temperature is below 55 degrees F and proper ventilation is not provided to eliminate excessive moisture from building.
- B. Protect work in progress as well as work of other trades. Clean surfaces that have been spotted during wallboard application.

1.07 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 00 72 00.
- B. Provide product data on metal framing, gypsum board, joint tape, and topping compound.
- C. Submit manufacturer's installation instructions under provisions of Section 00 72 00.
- D. Submit 2' x 2' sample of all specified finish levels and textures.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS GYPSUM BOARD SYSTEM

- A. U.S. Gypsum Co.
- B. Other acceptable manufacturers offering equivalent products:
 - 1. Pabco Gypsum Co.
 - 2. Domtar America, Inc.
 - 3. Gold Bond Building Products.

4. Georgia-Pacific Corp.
5. National Gypsum.
6. Or approved equal.

2.02 GYPSUM BOARD MATERIALS

- A. **Type 1 – Regular:** Regular Firecode Cores Gypsum Wallboard: ASTM C1396, ASTM C840, 5/8 inch thick, Firecode Core (Type X), maximum permissible length; ends square cut, tapered edges. USG Model No. WB1473.
 1. Provide at all ceiling and soffit locations and at wall locations not specified to receive other wallboard types.
- B. **Type 3 – Moisture & Impact Resistant:** Mold Tough VHI Firecode Cores Gypsum Wallboard: ASTM C473, ASTM D3273, ASTM C1396, ASTM C1629 and ASTM C630, Abuse Resistant, Firecode Core (Type X), 5/8 inch thick, with tapered and wrapped edges. USG Model No. WB2529.
 1. Provide on entire wall where moisture will be present such as toilet rooms, janitor rooms, kitchens, behind new ceramic wall tile and other areas where water will be present. Also provide within 5 feet of all sinks and drinking fountains.

2.03 ACCESSORIES

- A. Acoustical Sealant: Non hardening, non-skinning, for use in conjunction with gypsum board; "Acoustical Sealant" manufactured by Tremco.
- B. Corner Beads: Fine mesh expanded metal wing type, zinc coated in conformance with ASTM A525, G90 coating designation.
- C. Edge Trim: GA 216; Type "J" bead.
- D. Joint Materials: GA 216; reinforcing tape, joint compound, adhesive, water, and fasteners.
- E. Fasteners: General provide specific fasteners required for fire rated assemblies.
 1. Use Type S screws for gypsum board attachment to light steel framing.
 2. Use Type S screws for gypsum board attachment to 20 gauge and heavier steel framing.
 3. Use Type W screws for gypsum board attachment to wood framing.
 4. Use Type G screws for gypsum board attachment to gypsum board.

- 5. Use Annular ring nails, conforming to ANSI/ASTM C514, sufficient length to provide a minimum of 3/4 inch penetration into framing members.
- F. Setting Compound: Durabond as manufactured by USG. For use at all locations where gypsum board is in direct contact with concrete curbs.
- G. High build PVA Primer: Kelly More Level 5 Interior PVA Primer, USG First Coat Primer, or approved equal.
- H. Electrical Box Sealer: Lowry's "Electrical Box Pads", 6" x 8" x 1-1/8" resilient sealer pads.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Check framing for accurate spacing and alignment.
- C. Do not proceed with installation of wallboard until deficiencies are corrected and surfaces to receive wallboard are acceptable.
- D. The Painting Contractor shall not be required to accept the gypsum wallboard installation until after they have applied sealer. At that time, they shall inspect the installation and report to the General Contractor, with a letter to the Architect, of any surface damage, defects, or uneven walls. Uneven walls shall mean those that are not straight, plumb or of an even, true plane. All such discrepancies shall be the responsibility of gypsum wallboard installer and shall be corrected by them prior to application of further wall decoration.
- E. Beginning of installation means acceptance of existing surfaces substrate.

3.02 ACOUSTICAL ACCESSORIES INSTALLATION

- A. Install acoustical sealant within partitions in accordance with manufacturer's instructions.
- B. Install resilient sealer pads over backs and sides of electrical junction boxes.

3.03 GYPSUM BOARD INSTALLATION

- A. Prior to installation of any gypsum board product, Contractor shall review locations of all toilet room accessories with owner as required by Section 10800 to place all backing required.
- B. Install gypsum board in accordance with GA 216 and ASTM C840.
- C. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

- D. Use screws when fastening gypsum board to metal furring or framing, or 1x framing.
- E. Use screws when fastening gypsum board to wood furring or framing.
- F. Fasteners for all vertical gypsum boards shall be placed at 8" at the perimeter and 12" in field U.O.N. on drawings.
- G. Treat cut edges and holes in moisture resistant gypsum board with sealant.
- H. Place control joints consistent with lines of building spaces as indicated by Architect.
- I. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- J. Contractor shall provide new mud ring extensions for all electrical switch and outlets to allow device to flush with face of new gypsum board surface.
- K. At all locations where gypsum board extends past bottom sill plate and contacts face of curb, apply Durabond product to back side of gypsum board per manufacturer's recommendations to secure to face of concrete curb. Provide moderate pressure and temporary nailing or shoring to ensure adequate bond.

3.04 JOINT TREATMENT AND FINISH TEXTURE

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- C. All spaces not further identified below which are scheduled to receive finish painting shall be finished to Level 4 as described by the USG Corporation and receive a spray applied, LIGHT orange peel texture. Texture shall be light, tight and uniform.
- D. Toilet rooms and custodial room wall and ceiling surfaces not covered by ceramic tile or other wall finish shall be finished to Level 5 as described the USG Corporation.
- E. All hard lid gypsum wallboard ceilings shall be finished to Level 5.
- F. At all locations behind permanently fixed casework and where gypsum board is covered by plywood panels, gypsum board shall receive a Level 2 finish or as otherwise required at fire rated walls to achieve specified fire rating.
- G. All exposed gypsum board surfaces and surfaces behind Fiber Reinforced Laminate (FRL) wall coverings shall be finished to Level 5 as described by the USG Corporation with no texture. A spray applied primer surfacer is not acceptable as an alternative to providing required levels of troweled compound and thorough sanding. Poor wall finish will telegraph through FRL.

3.05 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

3.06 ADJUST AND CLEAN

- A. Cleaning and Repair: Clean surfaces that have been spotted or soiled during wallboard application. Contractor shall clean all light fixture lenses, fire alarm devices, electrical outlets, as performing work.
- B. Defective Work: Remove and replace defective work which cannot be satisfactorily repaired, at the direction of the Architect, with no additional cost to the Owner.
- C. Protection: Protect installed work against damage from other construction work.

3.07 CLEAN-UP

- A. Upon completion of the work under this Section, remove all surplus material, rubbish and debris from the premises and leave floors "broom clean".

END OF SECTION

**SECTION 09 30 13
CERAMIC TILE WORK**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Ceramic wall and base tile using the thin-set application method per TCA W242 U.O.N.

1.02 RELATED SECTIONS

- A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 07 90 00: Joint Sealers.
- C. Section 09 21 16: Gypsum Board Systems.
- D. Section 09 67 00: Urethane Concrete Flooring System.
- E. Section 10 26 00: Wall Protection.

1.03 REFERENCES

- A. ANSI/TCA A118.4 - Latex-Portland Cement Mortar.
- B. ANSI/TCA A137.1 - Specifications for Ceramic Tile.
- C. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation.
- D. ASTM C144-11 - Aggregate for Masonry Mortar.
- E. ASTM C150 /C150M-16e1 - Portland Cement.
- F. ISO 13007 - Standards for ceramic tiles, grouts and adhesives.

1.04 SUBMITTALS

- A. Submit per the requirements of the General Conditions.
- B. Submit shop drawings indicating tile layout, perimeter conditions, junctions with dissimilar materials, thresholds, and setting details.
- C. Submit product data under provisions of the General Conditions.
- D. Submit product data indicating material specifications, characteristics, and instructions for using adhesives and grouts.
- E. Submit samples under provisions of the General Conditions. Provide existing tile sample with

new sample for comparison at patch repair work.

- F. Submit manufacturer's installation instructions under provisions of Division 0, General Conditions.
- G. Submit maintenance data under provisions of Division 0, General Conditions.
- H. Include recommended cleaning and stain removal methods, and cleaning materials.

1.05 QUALITY ASSURANCE

- A. Conform to ANSI/TCA A137.1
- B. Conform to TCA Handbook for Ceramic Tile Installation, latest edition.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum three years of experience.
- B. Installer: Company specializing in applying the work of this Section with minimum three (3) years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of the General Conditions.
- B. Store and protect products under provisions of the General Conditions.
- C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in a closed, unventilated environment.
- B. Maintain 50 degrees F during installation of mortar materials.

PART 2 – PRODUCTS

2.01 MANUFACTURERS - TILE

- A. DAL-TILE (specified).
- B. AMERICAN OLEAN.
- C. Approved equal meeting all material, size and color criteria specified herein.

2.02 TILE MATERIAL

- A. **Type CT-1**, All Areas: Ceramic Wall Tile including Accent Colors: ANSI/TCA A137.1, conforming to the following:

Mfr. Line: **Daltile Classic Color Wheel Collection – Glazed Ceramic Wall Tile**
Size: 4" x 4" x 1/4" and corresponding profiles.
Edge: Cushioned.
Shapes: Provide all interior and exterior corners and bullnose ends pieces as required for a complete installation. Provide cove base profiles where integral epoxy floor base is not scheduled.
Surface Finish: Semi-Gloss and/or Matte Glazed, Smooth.
Colors: Allow for 1 field color and up to 5 accent color as selected by Architect from Manufacturer's full range of standard and premium colors from specified product line at time of submittal. See drawings for pattern layouts where occur.

2.03 ADHESIVE MATERIALS

- A. Latex White Multi-Mastic Type 2 (Laticrete 15) for walls, ANSI A136.1.
B. MAPEI, Type 1 Mastic-ANSI A136.1 and ISO 13007; DT1E.
C. Ardex D-14.

2.04 GROUT MATERIALS

- A. Wall Grout: 100% solids epoxy, Laticrete SpectraLock 2000 IG or Laticrete SpectraLOCK PRO Grout. Color to be selected by Architect at time of submittal from manufacturer's full range of standard colors. Allow for different grout colors in different rooms.
B. MAPEI; Kerapoxy - ANSI A118.3 and ISO 13007; RG.

2.05 GROUT MIX

- A. Mix and proportion pre-mix grout materials in accordance with manufacturer's instructions. Grout shall be manufactured by Laticrete International, Inc. Colors as selected by Architect.

2.06 ACCESSORIES

- A. Cleavage Membrane: ASTM C226 No. 15 asphalt saturated felt or ASTM C171 4 mil. thick polyethylene film.
B. Reinforcing Mesh: 2x2 inch size weave of 16/16 wire size; welded fabric, galvanized. Conform to ASTM A82 & A185.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive Work.

- B. Beginning of installation means installer accepts condition of existing substrate.

3.02 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean existing substrate and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Apply sealer to surfaces as recommended by adhesive manufacturer.

3.03 INSTALLATION

- A. Install all tile in accordance with TCA Handbook, latest edition, for Ceramic Tile Installation.
- B. Request tile pattern from Architect if not shown on Drawings. Do not interrupt tile pattern through openings.
- C. Cut and fit tile tight to penetrations through tile and provide caulk joint. Form corners and bases neatly. Align floor, base, and wall joints.
- D. Place tile joints uniform in width. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Sound tiles after setting and replace any hollow units.
- F. Allow tile to set for a minimum of 48 hours prior to grouting.
- G. Provide control joints around all dissimilar materials, penetrations, transition at wall to ceiling and walls to floor, inside corners, over existing building joints and in field at TCA recommended intervals. All control joints shall extend through setting bed and be caulked with sanded sealant to match grout joints.
- H. Coursing: Install in stacked bond pattern with vertical and horizontal grout lines aligning.

3.04 CLEANING

- A. Clean work under provisions of the General Conditions.
- B. Clean tile surfaces.

3.05 PROTECTION

- A. Protect finished installation under provisions of the General Conditions.
- B. Do not permit traffic over finished floor surface.

END OF SECTION 09 30 13

SECTION 09 65 16

RESILIENT FLOORING AND BASE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Resilient Luxury Vinyl Tile Flooring.
- B. Topset Resilient Base.
- C. Accessories.

1.03 SUBMITTALS

- A. Submit per the requirements the General Conditions for each product specified.
 - 1. Product Data: Provide product data describing physical and performance characteristics, sizes, patterns, colors, material safety data sheets and manufacture’s installation instructions for all proposed products.
 - 2. Submit samples for color selection illustrating color and pattern for floor material.

1.04 QUALITY ASSURANCE

- A. Flooring Contractor Installer Qualifications:
 - 1. Flooring Contractor to be an established firm experienced in the installation of the specified product and shall have access to all manufacturers’ required technical, maintenance, specifications and related documents.
 - 2. Floor covering installer must be factory trained and certified for the installation of the specific products being installed.
 - 3. Installer to provide project inspector proof of certification prior to starting work.
 - 4. Certified installer must be present on job site while work is in progress.

1.05 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials protected for exposure to harmful weather conditions and at a

temperature and humidity conditions recommended by manufacturer. Materials should be stored in areas that are fully enclosed, weather tight with the permanent HVAC system set at a uniform temperature of at least 65 degrees F 48 hours prior to, during and after installation. Maintain ambient relative humidity between 40% and 60% during installation.

1.06 WARRANTY

- A. Installation Warranty: Two (2) year installation warranty commencing on recordation date of the Notice of Completion.
- B. Manufacturer's Warranty: Five (5) year manufacturer warranty commencing on recordation date of the Notice of Completion.

PART 2 – PRODUCTS

2.01 RESILIENT VINYL PLANK FLOORING (LVT)

- A. Manufacturer
 - 1. Interface
www.interface.com
 - 2. Approved equal meeting all specified requirements herein, including matching colors, textures and patterns.
- B. Performance Requirements
 - 1. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 2. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
 - 3. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Product Type, **LVT-1, Interface, "Studio Set" line.**
 - 1. Construction: High Performance Luxury Vinyl Tile
 - 2. Class / ASTM F1700: Class III Printed Vinyl Plank
 - 3. Wear Layer Thickness: 22 mil.
 - 4. Total Thickness: 4.5 mm
 - 5. Backing Class: Commercial Grade
 - 6. Finish: Ceramor
 - 7. Nominal Dims. 25 cm x 1 m (9.85" x 39.4")
 - 8. Slip Resistance (ASTM D2047) >0.55 wet/dry, ADA Compliant
 - 9. Static Load Limit (ASTM F970) 1,500 psi
 - 10. Flexibility (ASTM F137) Passes
 - 11. Radiant Flux (ASTM E648) Class I
 - 12. Residual Indentation (ASTM F1914) Passes
 - 13. Chemical Resistance (ASTM F925) Passes
 - 14. Color/Texture As selected by Architect at time of submittal
 - 15. Color Allowance See drawings for quantities and distribution

16. Install Pattern Ashlar
17. Installation Materials
 - a. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.
 - b. Adhesives: XL Brands Adhesive 2000 Plus, XL Brands HM99 High Moisture Adhesive as recommended by Interface to meet site conditions.

2.02 HOMOGENOUS VINLY SHEET FLOORING

- A. Manufacturer
 1. Tarkett
 2. Approved equal meeting all specified requirements herein, including matching colors, textures and patterns.
- B. Performance Requirements
 1. Fire-Test-Response Characteristics: For homogenous sheet vinyl flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 2. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
 3. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Product Type, **VNYL-1, Tarkett iQ Granite/iQ Optima**
 1. Construction: Homogenous sheet vinyl
 2. Class / ASTM F1700: Class 1
 3. Total Thickness: 2 mm
 4. Meets performance standards of ASTM F1913
 5. Standard Specification for Vinyl Sheet Floor Covering without Backing and ASTM F1700
 6. Polyurethane Reinforced (ASTM F410): Yes
 7. Flexibility (ASTM F137): Passes
 8. Total Thickness (ASTM F386): 0.080 in. (2 mm)
 9. Static Load Limit (ASTM F970): 250 psi \leq 0.005" *Modified 2000 psi: \leq 0.005"
 10. Resistance to Heat (ASTM F1514): $\Delta E \leq 8$
 11. Resistance to Light (ASTM F 515): $\Delta E \leq 8$
 12. Clean Room (ISO 14644-1): ISO Class 4
 13. Slip Resistance (ASTM D2047): SCOF \geq 0.5
 14. Fire Performance (ASTM E648 Flooring Radiant Panel): CRF \geq 0.45 watts/cm², Class 1
 15. Chemical Resistance (ASTM F925): Passes
 16. INSTALLATION
 - a. See homogeneous sheet or tile flooring installation instructions for complete details.
 - b. Sheet Adhesive:
 1. Tarkett 925 Adhesive
 2. Tarkett 975 Two-Part Urethane Adhesive
 3. Tarkett 996 Two-Part Epoxy Adhesive
 4. Tarkett RollSmart Adhesive
 5. Tarkett Cold Weld Liquid

2.03 RUBBER BASE

- A. Manufacturer
 - 1. Roppe Rubber Corp. (Specified)
 - 2. Armstrong.
 - 3. Burke Industries.
 - 4.. Approved equal.
- B. Performance Requirements, **RB-1**
 - 1. Conforming to ASTM F 1861 or FS-SS-W-40, Type 1 with matching end stops and manufactured performed outside corners. 6" high and 1/8 inch gauge.
 - 2. Colors as selected by Architect from Manufacturer's full range of standard colors at time of submittal.
- C. Accessories
 - 1. Resilient Edge Strips/Reducer Strips: Tapered or bullnose, minimum of 1 inch wide, as recommended by flooring manufacturer for specific application. Use at transition from wainscot wall finish to painted gypsum board and as otherwise required at flooring transitions.
 - 2. Adhesive: Zero VOC, waterproof, high moisture rated, as recommended by flooring manufacturer for specific application.
 - 3. Primer: Non-staining type as recommended by flooring manufacturer.
 - 4. Leveling and Patching Compounds: Provide as recommended by flooring manufacturer for specific application.
- D. Provide a minimum of 10 lineal feet of base and transition pieces of each material and color specified.

2.04 ACCESSORIES

- A. Manufacturer's standard accessories not specified but required for a complete installation.

PART 3 – EXECUTION

3.01 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.

3.02 PREPARATION

- A. Prepare substrates according to Tarkett written instructions to ensure proper adhesion of Resilient Flooring.

- B. Prepare concrete substrates in accordance with ASTM F 710.
 - 1. Concrete floors must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitence, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.
 - 2. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
- C. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT PLANK FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient tile flooring.
- B. Luxury Vinyl Tile Flooring:
 - 1. Install with Interface adhesive specified for the site conditions and follow adhesive label for proper use.
 - 2. Follow manufacturer's recommendation for tile orientation for Ashlar pattern.
 - 3. Open enough cartons of floor tiles to cover each area, and mix tile to ensure shade variations do not occur within any one area.
 - 4. Roll the flooring in both directions using a 100 pound three-section roller.

3.04 BASE MATERIAL INSTALLATION

- A. Install resilient wall base on entire wall perimeter including toe spaces and open ends of cabinets and within accessible knee space of sink bases. Set all bases in adhesive as recommended by the manufacturer. All joints in bases, including those at any preformed comers, shall be plumb, flush, tight and inconspicuous. Seat top edge and back of base firmly against the wall. Interior corners shall be mitered and tightly fitted.

3.05 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.
1. No traffic for 24 hours after installation.
 2. No heavy traffic, rolling loads, or furniture placement for 48 hours after installation.
- D. Wait 48 hours after installation before performing initial cleaning.

END OF SECTION

SECTION 09 67 23

FLUID-APPLIED FLOORING - EPOXY

PART 1 – GENERAL

1.01 1.1 SUMMARY

A. Section Includes

1. Trowel applied monolithic epoxy {urethane} flooring [for kitchen and food processing use].
2. Perimeter edging and integral 1/2-inch coved base.

A. Related Sections

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 07 26 00 – Vapor Retarder.

1.02 REFERENCES

- A. ASTM D2240 – Standard Test Method for Rubber Property - Durometer Hardness.
- B. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
- C. ASTM E648 - Critical Radiant Flux of Floor Covering Systems
- D. ADA Standards – ADA Title [II] [III] Regulations and the ADA Standards for Accessible Design.
- E. CBC-8 - CBC Chapter 8, Interior Finishes
- F. CBC-11B - CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
- G. California Fire Code (CFC)
- H. NFPA 101 - Life Safety Code
- I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
- J. SMAQMD – Sacramento Metropolitan Air Quality Management District Regulations.

1.03 SUBMITTALS

A. Action Submittals

1. Product Data for each system component and accessory item
2. Certified Copies of Field Quality Assurance Test Reports
3. [Shop Drawings showing traffic areas that will receive non-slip finish and equipment and fixture layout that will receive standard smooth finish]

B. Information Submittals

1. Manufacturer's Installation Instructions
2. Certificates of Compliance regarding specified performance requirements

C. Closeout Submittals

1. Manufacturer's Maintenance Instructions

1.04 QUALITY ASSURANCE

A. Flooring system components shall be compliance with VOC content limits in SMAQMD [APCD-67.0].

B. [Installed flooring system shall have ASTM C1028, Coefficient of Friction, as follows.

1. Dry/Level Surfaces: 0.6, minimum.
2. Wet/Sloped Surfaces: 0.8, minimum.

C. Installed flooring system shall be CBC-8, Section 803.1, Class A interior finish with the following surface burning characteristics.

1. ASTM E84 Flame Spread: 25, maximum.
2. ASTM E84 Smoke Developed: 450, maximum.
3. ASTM E648, Critical Radiant Flux: NFPA 253, Class II, minimum 0.22 watts per square centimeter.

D. Manufacturer: company with minimum [10] [15] –years' experience manufacturing poured epoxy flooring for commercial projects similar in scale and complexity to those required for this Project.

E. Installer: company with minimum five (5) years' experience installing poured epoxy flooring for commercial [DSA inspected,] Projects similar in scale and complexity to those required for this Project.

1. Installer: approved by the materials manufacturer.
2. Installer shall have completed at least five (5) comparable projects that are more than two (2) years old; submit list with names and telephone numbers of knowledgeable client contacts.

- F. Field Sample. For each color and finish of fluid applied flooring, install a Field Sample with one corner as an exploded view showing each step in the process of surface preparation and installation.
1. Size: minimum 4- by 5-feet.
 2. Location: acceptable to Architect.
 3. Modify materials and methods of installation for each Field Sample as required to obtain Architect's approval.
 4. Document materials and methods used to obtain Architect's approval of each Field Sample. Maintain at least one copy of these documents in a readily accessible location on Site while this work is in progress.
 5. Maintain access to and protect Field Sample from damage while this work is in progress.
 6. [Upon acceptance of related work, Field Sample that remains in acceptable condition may remain as part of the work.]
 7. [Upon acceptance of related work, remove Field Sample from Site and correct occupied space to indicated conditions.]

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in un-opened containers, factory mixed and packaged.
- B. Store materials in a dry, secure area.

1.06 PROJECT REQUIREMENTS

- A. Do not install flooring when temperature is below 60 degrees F or above 90 degrees F.
- B. Maintain this temperature range, 24 hours before, during and 72 hours after installation of flooring.
- C. Restrict traffic from area where flooring is being installed or is curing.

1.07 WARRANTY [-EXTENDED]

- A. Manufacturer shall warrant installed flooring to be and to remain free from defect for a period of one (1) year [at least 3-years] from Date of Substantial Completion. Upon written notice from Owner, manufacturer shall promptly, without cost, and with least practicable inconvenience to Owner correct such defects.
- B. Evidence of defect in material, installation or both shall be delamination from substrate or degradation of surface finish individually or in combination.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products of the following manufacturers form the basis of design and quality intended for this Project.

1. Crossfield Products Corp., Compton, CA. Product: Dex-O-Tex
 2. Tera-Lite, Inc./Revolan Systems, San Jose, CA.
 3. Sherwin Williams - General Polymers, Cincinnati, OH
 4. Or equal, approved in accordance with Division 01 requirements for substitutions.
- B. Resinous Flooring: Dex-O-Tex, Cheminert K {Tek-Crete SL (self-leveling), urethane mortar} {Tek-Crete SL B (self-leveling) urethane mortar, Broadcast aggregate} {{Tek-Crete TT, troweled Urethane Mortar}}, meet or exceed the following physical properties when tested in accordance with the cited referenced standard test method.
1. Thickness: ¼ inch [1/8 inch]
 2. Compressive Strength (ASTM C579): 11,000 [[11,500]] {8,100} {{8,400}} psi.
 3. Tensile Strength (ASTM C307): 1,643 [[2,500]] {1,000} {{1,080}} psi.
 4. Flexural Modulus of Elasticity (ASTM C580): 4,300 [[4,500]] {2,000} {{2,000}} psi.
 5. Water Absorption (MIL D3134): 0.30 [[0.25]] {0.64} {{0.64}} percent max.
 6. Surface Hardness (ASTM D2240): 85.5 Durometer Shore "D" [[Durometer Shore D – 83]] {Durometer Shore D 85-90} {{Durometer Shore D85-90}}
 7. Abrasion Resistance (ASTM D1044): 0.0 gr. [[1000 cycles, wt. loss]]
 8. Impact Resistance (MIL-D-3134, Para 4.7.3): 0.024-inch max.
 9. Adhesion Impact Resistance (Gardner Impact Tester): No chipping, cracking, or delamination and not more than 0.014-inch indentation Adhesion (A.C.I. Comm. No. 503.1): 400 psi (100 percent failure in concrete)
 10. Electrical Conductivity (NFPA 56A): Di-electric
 11. Flammability-Critical Radiant Flux (ASTM E648): Greater than 1.07 watts/cm²
 12. Colors:
 - a. Solid colors: [As scheduled in Section 090600] [413 gray] [431 gray] [402 gray] [304 Beige] [211 green] [607 red] [blue] [as selected by Architect from manufacturer's full range of available colors.
 - b. [Grouted with selected variegated aggregates, top coated with clear finish coat.]
 13. [Skid Resistant Epoxy Coating with aluminum Oxide: Posi-Tred O, skid-resistant. Profile: Medium Profile, 23 mils [Fine Profile, 12 mils] [Coarse Profile, 50 mils]. Color as selected by Architect.]
 14. [Color quartz Topcoat: Terracolor aggregate.]
 15. {Tek-Crete SL B: Aggregate; natural mineral aggregate.}
 16. {Tek-Crete SL B: Top Coat; pigmented sealer; Dex-O-Tex Quik-Glaze}
 17. Dex-O-Tex Cheminert SC Membrane under flooring system.
 18. Antimicrobial Additive: anti-microbial biocide.
 19. Integral Cove Base and Top Coat: Tek-Crete VRT
 20. Vapor Control System: where moisture readings exceed 3 lbs/1000sq ft./24 hour period; Dex-O-Tex VaporControl Primer 200 [Specified in Section 072500].
- C. Resinous Flooring: Tera-Lite, Tera-Gem III Industrial Flooring System (IFS) {Tera-Gem III Chemical Resistant Flooring System (CRS)} {{Tera-Gem III Decorative Quality Troweled Flooring System (DQ)}}, epoxy flooring, meet or exceed the following physical properties when tested in accordance with the cited referenced standard test method.

1. Thickness: ¼ inch [1/8 inch]
2. Compressive Strength (ASTM C579): 11,500 {{10,500}} psi.
3. Tensile Strength (ASTM C307): 6,000 {{5,000}} psi.
4. Flexural Modulus of Elasticity (ASTM C580): 4,500 {{4,700}} psi.
5. Water Absorption (MIL D3134): 0.25 percent max.
6. Surface Hardness (ASTM D2240): Shore D – 83 {{82}}
7. Abrasion Resistance (ASTM D1044): 1000 cycles, wt. loss
8. Impact Resistance (MIL-D-3134, Para 4.7.3) no cracking or delamination at: 16 ft. lbs.
9. Adhesion Impact Resistance (Gardner Impact Tester): No chipping, cracking, or delamination and not more than 0.014-inch indentation Adhesion (A.C.I. Comm. No. 503.1): 400 psi (100 percent failure in concrete)
10. Electrical Conductivity (NFPA 56A): Di-electric
11. Flammability, ASTM E635: self-extinguishing
12. Colors:
 - a. Solid colors: [As scheduled in Section 099100] [gray] [tan] [green] [red] [blue] [as selected by Architect from manufacturer's full range of available colors.
 - b. [Grouted with selected variegated aggregates, top coated with clear finish coat.]
13. Primer: Two-component epoxy primer, liquid components, mix 2 parts of A to 1 part of B by volume. Stir with a mechanical agitator for 1-2 minutes. Distribute mixed material evenly over the floor surface using rollers, squeegees or spray. Spread rate will vary from 70 to 150 sq. ft. per gallon. Do not apply over standing water or let primer set before applying next coat.
14. Basecoat: Three-component, troweled polymer composite epoxy resin, curing agent, organic pigment and silica aggregate {{color quartz}} for Tera-Gem III IFS {CRS} {{Tera-Gem III for DQ}}. Liquid components at a ratio of 2 parts A to 1 part B by volume. To one weight equivalents of mixed liquid components add approximately 7-weight equivalent of aggregate. Mix all components using an electrical drill motor agitator or a plaster mixer. Mix all components for 2-3 minutes or until uniformly wetted, trowel to a thickness of ¼ inch.
15. Sealer: Liquid components with inorganic pigments {{DQ Clear liquid components}}, apply two (2) pigmented seal coats using the base coat liquid components, application rate approximately 125 sq. ft. per gallon.
16. [Anti-skid: No. 70 mesh silica sand or Flintshot. Applied to second seal coat.]
17. {{Quartz decorative finish: SpectraQuartz for Tera-Gem III DQ, color or blend as selected by Architect}}:

D. Flooring: Terracolor

1. Physical Properties: Provide flooring system that meet or exceed the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.
 - a. Thickness: ¼ inch
 - b. Compressive Strength (ASTM C 579): 10,716 psi
 - c. Tensile Strength (ASTM C 307): 1,843 psi
 - d. Surface Hardness (ASTM D-2240): Durometer "D" 81
 - e. Abrasion Resistance (ASTM D 1044): 0.0 gr.
 - f. Indentation (MIL-D-3134): <1.0 percent
 - g. Impact Resistance (Gardner Impact Tester): No chipping, cracking, or delamination

- h. Adhesion (A.G.I. Comm. No. 503.1):>400 psi (100 percent failure in concrete)
- i. Electrical Conductivity (NFPA 56A): Di-electric
- j. Flammability (ASTM E-648/NFPA 253/FTMS 372): Greater than 1.07 watts/cm² (Class I)]

E. Flooring: DEX-O-TEX Decor-Flor

1. Provide flooring system that meet or exceed the listed minimum typical physical properties at 75oF (24oC) tested according to referenced standard test method:

- a. Compressive Strength ASTM C579 10,500 psi
- b. (Resin, Hardener & Aggregate) (738 kg/cm²)
- c. Tensile Strength ASTM C307 1,800 psi
- d. (Resin, Hardener & Aggregate) (127 kg/cm²)
- e. Flexural Strength ASTM C580 4,000 psi (281 kg/cm²)
- f. Surface Hardness ASTM D2240 Shore D 80-85
- g. Indentation Characteristics
 - 1) (Steadily Applied Load) MIL-D-3134, 0.005 inch
 - 2) Para. 4.7.4.2.1, 2000 lbs. on 1 inch steel ram imposed for 30 minutes over concrete substrate, indented, (0.127 mm)
- h. Indentation Characteristics MIL-D-3134, Para. 4.7.3
 - 1) (Impact Load) 0.011 inch
 - 2) (2 lb. 0.908 kg.) Indent from steel ball dropped twice from 8 ft. height, (0.28 mm)
- i. Adhesion ASTM D4541 > 400 psi
 - 1) (100 percent failure in concrete) (28.1 kg/cm²)
- j. Water Absorption MIL-D-3134 < 1.0%
- k. Abrasion Resistance ASTM D4060
 - 1) (CS17, 1000gr load, 1000 cycles) 0.04 gr
- l. Flammability ASTM D635 Self-Extinguishing
Bonded to Concrete
- m. Skid Resistance Varies depending
upon surface
texture selected.

2.02 ACCESSORIES

- A. Waterproofing Membrane: Type recommended or produced by manufacturer for flooring system, for type of service and floor condition indicated. Fluid-Applied, Dex-O-Tex Cheminert SC Membrane or equal.
 - 1. Primer: manufacturer’s standard.
- B. Anti-Microbial Additive: Incorporate antimicrobial chemical additive to prevent growth of most bacteria, fungi, algae and actinomycetes.

- C. Vapor Control System: Tera-Lite III; Aquafin Vaportight Coat-SG3, epoxy-based, or as required by submitted system.
- D. Primer: manufacturer's bond coat.
- E. Floor transitions: Saw cut concrete and chamfer (Key in edge) to match level of existing flooring.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify Site conditions are ready for the work of this Section. Notify Architect and Inspector of Record at least 48-hours prior to installation of testing and at conclusion of tests.
 - 1. Concrete shall be cured minimum 28 days prior to application of sealer.
 - 2. Conduct ASTM F1869 calcium chloride dome tests to verify that concrete floors are dry within moisture vapor emissions limits of flooring system manufacturer. Set one test for each 1,000 sf. of floor area but at least in four (4) in each different areas or location.
 - 3. Conduct ASTM F710 alkalinity testing of concrete substrate; pH levels shall not exceed the recommendations of the floor coating manufacturer, the adhesive manufacturer, or both.
 - 4. Conduct Relative Humidity Test Method in accordance with ASTM F 2170 with a Wagner Rapid RH probe to verify relative humidity and surface pH, ASTM F710, of concrete floor slabs, the method
 - a. Requires drilling holes at diameter not to exceed outside diameter of probe by more than 0.04 inch to depth equal to 40 percent of slab's thickness (elevated structural slab shall be tested at depth equal to 20 percent of slab thickness).
 - b. Place probe to full depth of test hole, place cap over probe.
 - c. Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
 - d. Remove cap and press button on the probe to obtain reading.
 - e. Relative humidity readings for substrates receiving non-permeable flooring are 75 percent or lower.
 - f. Testing shall require three (3) tests in first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.
 - g. Alkalinity testing: follow procedures per ASTM F710, ranges shall not exceed those recommended by the flooring manufacturer.
- B. Do not begin installation until unsatisfactory conditions are corrected. Beginning installation means acceptance of existing conditions and preparatory work of others.

3.02 PREPARATION:

- A. Install Vapor Emission Treatment Systems per Section 090561.13 where tests reveal presence of more than acceptable moisture level in accordance with Test Method ASTM F 1869 and ASTM F 2170.

- B. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect floor coating appearance or performance.
 - 1. Surface shall be free of soil, dust, base material, oil, grease, paint, curing compounds and other foreign matter.
 - 2. Surface shall be cleaned and allowed to dry thoroughly. Cleanse dirty or contaminated floors with approved cleaner as per manufacturer's instructions. Rinse thoroughly with clean water.
 - 3. Contaminated Concrete Surfaces: clean concrete surfaces by sandblasting, steel shot-blasted, scarified, water blasted, or other approved technique by the flooring manufacturer.
- C. Repair minor defects. The substrate was prepared under Section [03 01 30.71] [03 01 30.72] [03 30 00]; remove ridges, fill depressions and repair cracks as required by floor coating manufacturer to execute specified warranty.
 - 1. Apply, trowel and float filler to leave a smooth, flat, hard surface, free of bumps or depressions of any size.
 - 2. Prohibit traffic from area until filler is cured.
- D. Vacuum clean substrate.
- E. Apply primer as recommended by the materials manufacturer.
- F. Install waterproof membrane per manufacturer's recommendations.

3.03 INSTALLATION

- A. Mix components according to manufacturer's recommendations.
- B. Apply primer (bonding coat) per manufacturer's recommendation.
- C. Trowel apply ¼ inch [1/4 inch for Terracolor] thick body coat. Build up in minimum of two (2) coats.
- D. Body Coat: Over prepared surface, screed mortar mix at nominal ¼ inch thickness. Allow material flow out and being to settle. Back roll with a spike roller or looped roller to distribute material smooth even finish.
- E. Slip Resistant Finish:
 - 1. Broadcast slip resistant finish into wet coating at rate recommended by manufacturer to achieve specified coefficient of friction. Backroll to encapsulate and distribute aggregate.
 - 2. Remove Excess Aggregate: Remove all loose or unsound aggregate from the cured surface. Vacuum up all dust and fine particles from the surface, remove any ridge lines and detail all imperfection in the textured surface.
 - 4. [Power sand to remove trowel marks.
- F. Sealer: apply two (2) seal coats using the base coat liquid components. Sand between coats. Apply the first seal coat. Let the surface set. Mix and place the second seal coat similarly to the first coat,

application rate approximately 125 sq. ft. per gallon. During second seal coat broadcast a graded silica aggregate for anti-skid and backroll.

- G. Pigmented Sealer for Tek-Crete SL B: Dex-O-Tex Quik-Glaze, apply over slurry mortar.
- H. Integral Base Application: Apply vertical areas with same materials or base material specified. Height of integral base application: 6 inches, including ½ inch covered radius, unless otherwise indicated. Mask off base to provide a straight, neat, level top edge.
- I. Apply clear sealer, or pigmented where scheduled, top coat per manufacturer's instructions.

3.04 PROTECTION

- A. Protect finished installation from traffic until curing is complete.

END OF SECTION

SECTION 09 67 24

URETHANE SLURRY FLOORING SYSTEM (KITCHENS)

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. High-performance resinous flooring systems.
- B. Related Sections:
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Section 07 26 00 – Vapor Retarder.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Installer Certificates for Qualification: Signed by manufacturer certifying that installers comply with specified requirements.
- C. Material Certificates: For each resinous flooring component, from manufacturer.
- D. Material Test Reports: For each resinous flooring system.
- E. Maintenance Data: For maintenance manuals.
- F. Samples: Submit one sample of coating, indicating coating applied on horizontal surfaces. Sample shall illustrate transition from Resinous Flooring system. Provide sample which is a true representation of proposed field applied finish; not laboratory applied finish. Provide minimum 12 feet by 4 feet field sample color and texture for owner approval as a mock up at location designated by General Contractor for review and written approval prior to installation of any other areas.
- G. Product Schedule: For resinous flooring.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

2. Installer Letter of Certification: Installer to provide letter stating that they have been in business for at least 10 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.
- D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
 1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
 2. Simulate finished lighting conditions for Architect's review of mockups.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 4. Mockup shall demonstrate desired slip resistance for review and approval by General Contractor prior to installing project areas.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. The Sherwin-Williams Company

2.02 MATERIALS

- A. Fastop™ Topfloor SL57, with cove, as manufactured by Sherwin-Williams, consists of FasTop™ 4040 (Cove pr), FasTop™ 4060, 5055 Aggregate (Cove), FasTop™ 4050, with 5050 Aggregate as slurry, 5310-8 Dry Silica Sand (20-40 Mesh) for broadcast and Elladur™ 4850 as a seal coat at a ¼" nominal.
- B. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
1. Resinous Flooring: 100 g/L.
 2. High-Performance Resinous Flooring
 - a. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.
 - b. System Characteristics:
 - 1) Color and Pattern: As indicated from manufacturers listed above.
 - 2) Slip Resistance: Provide slip resistant finish.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Environmental Conditions
1. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly followed.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 3. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
 4. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
 5. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
 6. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.02 PREPARATION

- A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces. Test and report for moisture level in substrate to verify compliance with manufacturer's requirements. Do not proceed unless acceptable test results are achieved.
- B. Only installers approved by the manufacturer in writing shall perform installation of the material.
- C. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:
- | | |
|---|----------------|
| 1. Thin film, to 10 mils | CSP-1 to CSP-3 |
| 2. Thin and medium films, 10 to 40 mils | CSP-3 to CSP-5 |
| 3. Self-leveling mortars, to 3/16" | CSP-4 to CSP-6 |
| 4. Mortars and laminates, to 1/4" or more | CSP-5 to CSP-9 |

3.03 APPLICATION

- A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
 2. Install topcoat over flooring after excess aggregate has been removed.
 3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping.
- B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

- C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill saw cuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
 - 1. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
 - 2. Slip Resistant Finish: Provide grit for slip resistance.
 - 3. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.04 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all splatterings and drippings, and all resulting stains.
- B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- C. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION

SECTION 09 68 00

CARPET

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Broadloom and carpet tile.
2. Integrated walk-off mats
3. Accessories
4. Subfloor testing and preparation.
5. Installation of vapor retarder if required.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
3. Section 03 31 00: Cast-in-Place Concrete.
4. Section 07 26 00: Vapor Retarders
5. Section 09 21 16: Gypsum Board Systems: Wall materials to receive base.
6. Section 09 65 00: Resilient Flooring.

1.02 REFERENCES

- A. ANSI/ASTM E648-15e1 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- B. ASTM F1869-16 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.03 QUALITY ASSURANCE

A. Manufacturer, Contractor, and Installer Qualifications:

1. Manufacturer: Company specializing in contract flooring with ten-years minimum experience.
2. Flooring Contractor: Company with five years minimum documented experience, approved by manufacturer for the installation of the specified products and shall have access to all manufacturers required technical, maintenance, specifications and related documents.
3. Installer:
 - a. Floor covering installer must be factory trained and certified for the installation of the specific products being installed.
 - b. Installer to provide project inspector proof of certification prior to starting work.
 - c. Certified installer must be present on job site while work is in progress.

4. Testing Laboratory:

- a. Certified, bonded, qualified and experienced agency to perform pH and Relative Humidity (RH) emission tests.

B. Pre-Floor Covering Installation Meeting:

1. Contactor to notify Construction Manager with a minimum of 5-days' notice when anticipated to be ready for pre-floor covering installation meeting. (After subfloor preparation is complete and ready for floor covering installation.)
2. Contractor, installer, and manufacturer representative are required to attend pre-floor covering meeting. Contractor is responsible for coordinating and scheduling their attendance.
3. Construction Manager will schedule meeting with Contractor team, Project Inspector, and Architect.
4. Purpose of Meeting: To review subfloor preparation, verification of readiness for floor covering installation and use of correct products, verification of the acclimation of correct finish materials and review installation requirements.

C. Manufacturer's Field Services:

1. Manufacturer representative to attend the "Pre-Flooring" meeting.
2. Upon Owner or Architect's request, and with at least 72-hour notice, provide manufacturer's representative site visit(s) for inspection of product installation.
3. At the Owner's request, manufacturer representative to attend operation and maintenance training meeting for Owner's custodial staff prior to acceptance of floor covering installation.

1.04 SUBMITTALS

A. Provide a complete submittal package with all components required within this section. Submit per Section 01 33 00.

1. Product Data: Provide product data describing physical and performance characteristics, sizes, patterns, colors, material safety data sheets, and method of seaming and manufacture's installation instructions for all proposed products.
2. Shop Drawings:
 - a. Provide a floor plan indicating all proposed seam locations and integrated walk-off mats. Indicate method of joining seams, and direction of carpet.
3. Samples:
 - a. Submit samples for color selection illustrating color and pattern for floor material with samples of matching walk-off mats, rubber base and transition material proposed for installation.
 - b. Submit sample of solvent welded seam.
4. Maintenance Data: Submit manufacturers recommend cleaning and maintenance data. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

5. Recycled Content Percentage Submittals
6. Submit a statement signed by the manufacturer's Executive Officer or independent certification third-party that the provided carpet materials have the specified recycled material percentage.
7. Submit documentation of manufacturer's take-back program for carpet. Including:
 - a. Confirmation that the new carpet being installed will be accepted (at the point of future replacement) through a manufacturer's operated program for recycling or reuse;
 - b. Written description of such a process for the recycling and/or recovery of used/worn products;
 - c. Contact information for the take-back program.
8. Existing Carpet Recycling Plan and Recycling Certification. Submit documentation describing the reclamation plan for existing carpet. Include appropriate contact information, overview of procedures, and limitations and conditions applicable to the project Carpet recycling options consist of:
 1. Repurposing - reusing the product in another application such as facilitating the donation of used carpeting to charities and other nonprofit organizations.
 2. Closed Loop Recycling - turning waste materials into new materials of the same value, such as vinyl backing into vinyl backing and nylon yarn into nylon carpet yarn.
 3. Open Loop Recycling – creating other product types from reclaimed carpet. For example, turning nylon face fiber into automotive parts or carpet padding, including nylon face fiber in recycled backings
 4. Waste-to-Energy - using carpet for waste-to-energy. In the case of waste-to-energy, manufacturer shall justify why carpet cannot be recycled as this method should be a last resort.
 5. Landfill or incineration – are not approved disposal methods
 6. At the completion of the project, a certificate shall be furnished verifying the reclamation of the carpet and the pounds of material diverted from the landfill.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 33 00.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule and products for cleaning.
- C. Provide in-service training with Owner's custodial staff prior to acceptance of flooring for proper care and maintenance of carpet. Also review and provide recommended type of furniture casters and glides.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials protected for exposure to harmful weather conditions and at a temperature and humidity conditions recommended by manufacturer. Materials should be stored in

areas that are fully enclosed, weather tight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hours prior to, during and after installation.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain minimum 70 F ambient temperature at floor level three days prior to, during, and 24 hours after installation of materials.
- C. Prior to testing for moisture vapor emission rate, space shall be enclosed, fully weather-tight, wet-work in space shall be completed and nominally dry, work above ceilings finished. The test site should be at the same temperature and humidity expected during normal use.
- D. Maintain lighting at a minimum uniform level of 50 or more-foot candles in areas where the floor system is being installed.
- E. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- F. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants.
- G. Floor temperature should be 60 °F minimum for proper adhesive curing and performance.
- H. If subfloor is contaminated with an oily residue either from removal of "cutback" during asbestos abatement or from a previous end use such as metal fabrication, this residue MUST be totally removed or covered prior to applying modular adhesive and carpet.

1.08 CONCRETE SUBFLOOR TESTING

- A. Testing for internal relative humidity of concrete slabs must be conducted in accordance with the current version of ASTM F2170, not to exceed manufacturer's requirements (ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes).
- B. The Flooring Contractor shall verify in writing to the Owner, a minimum of thirty (30) days prior to scheduled carpet installation, the following substrate conditions:
 - 1. Moisture: Initial emission rate, as tested with in-situ probes, per ASTM F 2170.
 - 2. Alkalinity: pH level. Testing the pH at the surface of a concrete slab must be conducted in accordance with the current version of ASTM F710, not to exceed manufacturer's requirements (ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.)
- C. High Moisture and /or Alkalinity Readings:
 - 1. New Construction (New Concrete Slab)

- a. If the Contractor's test results indicate that the slab relative humidity (RH) readings are below those of flooring manufacturer's requirement, then the Owner's representative will initiate independent testing to confirm results and will initiate additional testing using petrographic analysis to determine if the Water Cement Ratio and sufficient hydration has taken place.
 - 1) If it is determined that the Specifications were followed in their entirety, water/cement ratio (as specified), and or the concrete surface has been adequately hydrated; then the Contractor shall initiate a credit to the Owner for the cost of installation of the Vapor Retarders as specified in section 07 26 00 that were not installed.
- D. Comply with manufacturer's written requisites for field conditions including but not limited to testing for moisture, confirmation of vapor retarder, floor prep, bond test, photo documentation, etc.

1.09 EXTRA MATERIALS

- A. Provide a minimum of 4 square yards of each color installed. In addition, provide all usable scraps one sq. yd. or larger in size. Remnants shall be packaged, identified and delivered to the Owners Representative, who will retain any he chooses for future repairs before they are removed from the job site.

1.10 WARRANTY

- A. Manufacturer's Warranty: Twenty (20) year minimum manufacturer warranty commencing on recordation date of the Notice of Completion.
 1. Should carpet, tend to creep, bulge, be defective in manufacturing, or show a substantial amount of wear - carpet shall be replaced with new carpeting at no cost to the Owner. Manufacturer to submit written warranty covering the following:
 - a. 20 Year minimum, non-prorated Guarantee shall also include:
 - 1) No resiliency loss of backing.
 - 2) No zippering.
 - 3) Static protection (will not lose static property—will not give static discharge above 3.5KV).
 - 4) No edge ravel or zippering.
 - 5) Delamination.
 - 6) Surface wear (maintains at least 90% surface pile weight).
 - 7) No staining.
 - 8) Dimensional Stability.
 - 9) Moisture Resistance.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Carpet (Vinyl Cushioned Tufted Textile) and integrated walk-off mats: Color as selected by Architect from Manufacturer's full range of colors and patterns from specified product line. No other substitutions will be allowed.

1. **CRPT1** - Tandus Flooring – Broadloom Roll.
 - a. “Aftermath II” Series with custom Antron fibers, 6’-0” roll, glue down. Powerbond cushion RS vinyl backing system and seam sealer.
 2. **CRPT2** - Tandus Flooring – Broadloom Roll.
 - a. “Visual Path” Series with custom Antron fibers, 6’-0” roll, glue down. Powerbond cushion RS vinyl backing system and seam sealer.
 3. **CRPT3** - Tandus Flooring – Broadloom Roll.
 - a. “ColorKnit” Series with custom Antron fibers, 6’-0” roll, glue down. Powerbond cushion RS vinyl backing system and seam sealer.
 4. Walk-Off System – **WOM1**
 - a. Tandus “Abrasive Action II” walk-off system at all exterior doors in carpeted rooms. Color to be coordinated with carpet color selection.
- B. Primer:
1. Tandus Centiva: C-36E primer.
 2. Milliken: No required.
- C. Adhesives: Low VOC, waterproof, and as recommended by product manufacturer.
1. Tandus Centiva: C-16E Adhesive
 2. Milliken: Mosaic Moisture XT Spray.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. New Construction (New Concrete Slab)
1. Installer must examine areas and conditions under which resilient flooring and accessories are to be installed and must notify General Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Owner and Architect.
 2. Testing for internal relative humidity of concrete slabs must be conducted in accordance with the current version of ASTM F2170, not to exceed manufacturer’s requirements (ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes).
 3. Verify that new surfaces are smooth and flat with maximum variation as specified in 03 31 00- Structural Concrete and are ready to receive work.

4. Beginning of installation on new substrates means acceptance of substrate. The existing substrates will require as much preparation as necessary to provide proper installation of new materials.

3.02 PREPARATION

A. New Construction

1. Install underlayment where flooring is being installed on a wooden subfloor per the manufacturer's instructions.
2. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with manufacturer recommended subfloor filler.
3. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
4. Prohibit traffic from area until filler is cured.
5. Prepare floor substrate to be smooth, rigid, flat, level, permanently dry, clean and free of foreign materials such as dirt, paint, grease, oils, solvent, curing and hardening compounds, sealers, asphalt and old adhesive residue. Vacuum clean substrate.
6. Apply primer to concrete surfaces.

3.03 CARPET INSTALLATION

- A. Install in accordance with manufacturers' instructions and recommendations with fully welded seams.
- B. Install flooring square with room axis and in accordance with approved shop drawing.
- C. Layout roll-goods in a manner to minimize seams and avoid seams in traffic areas. End butt joints shall be kept to a minimum, shall be staggered, and shall occur where approved on detail plan layout. Use the largest sections possible to minimize seams. Avoid cross seams, filler pieces and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer recommendations.
- D. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- E. Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture, including pipes, outlets, edgings, thresholds, nosing and cabinets.
- F. Install edge strips at unprotected or exposed edges, and where flooring terminates.
- G. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.
- H. Adhere carpet to prepared substrate without producing open cracks, voids, raising and puckering at joints, telegraphing to adhesive spreader marks, or other surface imperfections in completed installation.
- I. Fully solvent weld all seams. Seams shall be unnoticeable in finished installation.
- J. Verify carpet match before cutting to ensure minimal variation between dye lots.

- K. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed.
- L. Lay carpet on floors with run of pile in same direction as anticipated traffic.
- M. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.
- N. Complete installation shall conform to the Carpet Installation Standard of Carpet and Rug Institute (CRI).

3.03 INTEGRATED WALK-OFF MAT INSTALLATION

- A. Install in accordance with manufacturers' instructions and recommendations.
- B. Install modular tile like any "dry-back" modular with a full-spread wet adhesive.
- C. Installation instructions for Tandus Floorcoverings' Powerbond Non-RS (dry-back) Modules can be used as "reference only."
- D. Adhesives below are offered to install modular tile product based upon application and intended use:
 - 1. #024 Solvent Free Outdoor Adhesive (Tandus SKU/Style # 919).
 - 2. #002 Premium Grade Multi-Purpose Adhesive (Tandus SKU/Style # 920).
 - 3. PS100 Pressure Sensitive Releasable Adhesive (Tandus SKU/Style # 923).
- E. Modular tile should be securely attached to the sub-floor in compliance with ADA Accessibility Guidelines, latest edition, for Building & Facilities, Section 4.5.3.
- F. Provide integrated walk-off mats at all exterior door location where carpet is indicated to be installed. The walk-off mats shall extend a minimum of the door width plus six inches (6") and six feet (6'-0") in the direction of travel or as indicated on the drawings.

3.04 INSTALLATION - BASE MATERIAL

- A. Install resilient wall base on entire wall perimeter including toe spaces and open ends of cabinets. Set all bases in adhesive as recommended by the manufacturer. All joints in bases shall be plumb, flush, tight and inconspicuous. Seat top edge and back of base firmly against the wall. Wrap base around all outside corners and no seams within 12" of corners. Interior corners shall be mitered and tightly fitted.

3.05 PROTECTION

- A. Prohibit traffic from carpet areas for 24 hours after installation.
- B. Protect flooring from damages by other trades prior to owner occupancy.

3.06 FINAL CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage. Remove and dispose of all small scraps, cartons, and rubbish upon completion of the work. Remove all loose threads with sharp scissors.
- B. Clean carpet of all spots with proper spot remover, and vacuum carpet surfaces.

END OF SECTION 09 68 00

SECTION 09 91 00

PAINING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field painting of exposed interior items and surfaces, including mechanical and electrical equipment that do not have a factory-applied finish.

1.2 RELATED SECTIONS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Section 05 50 00 - Metal Fabrications: Shop priming ferrous metal.
- C. Section 08 11 00 - Steel Doors and Frames: Factory priming steel doors and frames.
- D. Section 09 29 00.10 - Gypsum Board Assemblies: Surface preparation of gypsum board.
- E. Division 23: Mechanical.
- F. Division 26: Electrical.

1.3 REFERENCES

- A. ASTM International (ASTM): ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.
- C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.4 DEFINITIONS

- A. General: Standard coating terms defined within Masters Painters Institute (MPI) manual.
 - 1. Gloss level 1 - Flat with a gloss range below 5 when measured at a 60-degree meter and 10 when measured at an 85-degree meter.
 - 2. Gloss level 2 - Low Sheen with a gloss range of 5 to 10 when measured at a 60 degree meter and 10 to 35 when measured at an 85 degree meter.
 - 3. Gloss level 3 - Eggshell with a gloss range between 10 and 15 when measured at a 60-degree meter and 10 to 35 when measured at an 85-degree meter.
 - 4. Gloss level 4 - Satin with a gloss range between 25 to 35 when measured with a 60 degree meter.
 - 5. Gloss level 5 - Semi-Gloss with a gloss range between 50 and 55 when measured at a 60 degree meter.
 - 6. Gloss level 6 - Gloss with a gloss range more than 70 when measured at a 60 degree

meter.

1.5 SUBMITTALS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Preparation instructions and recommendations.
 - 3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Paint Exposed Surfaces: If an item or a surface is not specifically mentioned, paint the item, or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean

- condition, free of foreign materials and residue.
- C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - D. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C), unless manufacturer's instructions specifically states.
 - E. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
 - F. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities, described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Kelly-Moore Paints.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 PAINT MATERIALS - GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. VOC Classification: Provide materials, including primers, undercoats, and finish-coat materials, which meet local air quality management district regulations.
- C. Color: Refer to Finish Schedule and Paint Legend for paint colors.
- D. Application Rate: Coating thickness for primer, intermediate, barrier and finish coats shall be measured as Dry Film Thickness (DFT) and comply with manufacturer's published

recommendations.

2.3 Interior Paint Systems

- A. Gypsum and Plaster Walls:
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1010 Premium Professional Eggshell Enamel
 - c. 3rd Coat: KM 1010 Premium Professional Eggshell Enamel

- B. Suspended and Surface applied Ceilings:
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1002 Ceiling Paint Flat Finish
 - c. 3rd Coat: KM 1002 Ceiling Paint Flat Finish

- C. Wood Doors & Frames (Painted Finish):
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- D. Previously Painted Wood:
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- E. Wood Previously Stained to be Painted:
 - a. Prime Coat: KM 265 Kel-Bond Hybrid Water-Borne Alkyd Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- F. Wood to be re-finished and sealed:
 - a. 2 Coats: Old Masters Master Armor Satin Finish

- G. Metal Doors and Frames:
 - a. Prime Coat: KM 6646 DTM Eggshell Primer Finish
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- H. Vinyl Tackable wall Panels:
 - a. Prime Coat: KM Zinsser B-I-N Shellac Base Primer
 - b. 2nd Coat: KM 1010 Premium Professional Low VOC Eggshell Enamel
 - c. 3rd Coat: KM 1010 Premium Professional Low VOC Eggshell Enamel

2.4 Exterior Paint Systems

- A. Concrete Substrates, Masonry, Stucco, Non-Traffic Surfaces:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. 2nd Coat: KM 1247 Acryshield 100% Acrylic Exterior Satin Enamel
 - c. 3rd Coat: KM 1247 Acryshield 100% Acrylic Exterior Satin Enamel

- B. Wood Siding:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. 2nd Coat: KM 1247 Acryshield 100% Acrylic Exterior Satin Finish
 - c. 3rd Coat: KM 1247 Acryshield 100 Acrylic Exterior Satin Finish

- C. Wood Fascia:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. KM 1250 Acryshield 100% Acrylic Exterior Semi-Gloss Enamel
 - c. KM 1250 Acryshield 100% Acrylic Exterior Semi-Gloss Enamel

- D. Wood Benches:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. 2nd Coat: KM 1998 Epic Waterborne Urethane Alkyd Semi-Gloss Enamel
 - c. 3rd Coat: KM 1998 Epic Waterborne Urethane Alkyd Semi-Gloss Enamel

- E. Interior & Exterior Surfaces of Exterior Doors:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- H. Door Mullions at Pair Doors:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- I. Painted Infill Panels at window Locations:
 - a. Prime Coat: KM 2287 Kel-Bond Adhesion Plus Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- J. Ferrous Metal Substrates:
 - a. Prime Coat: KM 265 Kel-Bond HyBird Waterborne alkyd Primer
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- K. Metal Handrails, Guardrails, Barricade Rails & Fencing:
 - a. Prime Coat: KM 6646 DTM Eggshell Primer/Finish.
 - b. 2nd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel
 - c. 3rd Coat: KM 1828 Envy Acrylic Urethane Semi-Gloss Enamel

- L. Metal Panels Fascia:
 - a. Prime Coat: KM 98 Multi Seal Exterior Clear Sealer
 - b. 2nd Coat KM 1250 Acryshield 100% Acrylic Exterior Semi-Gloss Enamel
 - c. 3rd Coat: KM 1250 Acryshield 100% Acrylic Exterior Semi-Gloss Enamel

- M. Metal Gates:
 - a. Primer Coat: KM 6646 DTM Eggshell Primer/Finish

- b. 2nd Coat: KM 1998 Epic Waterborne Urethane Alkyd Semi-Gloss Enamel
- c. 3rd Coat: KM 1998 Epic Waterborne Urethane Alkyd Semi-Gloss Enamel

- N. Gutters, downspouts, Cap & Edge Flashings.
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1250 Acryshield 100% Acrylic Semi-Gloss Enamel
 - c. 3rd Coat: KM 1250 Acryshield 100% Acrylic Semi-Gloss Enamel

- O. Canopies Including Undersides:
 - a. Primer Coat: KM 6646 DTM Eggshell Primer/Finish
 - b. 2nd Coat: KM 6648 DTM Semi-Gloss Enamel
 - c. 3rd Coat: KM 6648 DTM Semi-Gloss Enamel

- P. Extended Roof Overhangs and Covered Walks Including Undersides:
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1247 Acryshield 100% Acrylic Satin Finish
 - c. 3rd Coat: KM 1247 Acryshield 100% Acrylic Satin Finish

- Q. Relocatable Classroom Buildings and Skirts:
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1247 Acryshield 100% Acrylic Satin Finish
 - c. 3rd Coat: KM 1247 Acryshield 100% Acrylic Satin Finish

- R. Relocatable Building Ramp Skirts & Handrails:
 - a. Prime Coat: KM 295 Kel-Bond Universal Primer
 - b. 2nd Coat: KM 1247 Acryshield 100% Acrylic Satin Finish
 - c. 3rd Coat: KM 1247 Acryshield 100% Acrylic Satin Finish
 - d. Handrail's: 2 Coats: KM 1828 Envy Acrylic Urethane Enamel

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
 - 2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
 - 3. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to dull surfaces. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
 - a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - 4. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
 - b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
 - c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - d. Determine moisture content of surfaces by performing a moisture test. Do not coat if moisture content exceeds 15 percent.
 - 5. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
 - a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

- c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
- 6. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
 - a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
 - 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
 - 3. Use only the type of thinners approved by manufacturer and only within recommended limits.
 - 4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. General: Apply high-performance coatings according to manufacturer's written instructions.
 - 1. Use applicators and techniques best suited for the material being applied.
 - 2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
 - 3. Coating surface treatments, and finishes are indicated in the coating system descriptions.
 - 4. Provide finish coats compatible with primers used.
 - 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
- C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. The number of coats and film thickness required is the same regardless of application method.
 - 2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
 - 1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 - 2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing, or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
- C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 10 00 00

MISCELLANEOUS SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES:

- A. Provide and install specialty and built-in items as indicated on the Drawings and specified here.
 - 1. Aluminum Mini-blinds.
- B. Provide miscellaneous, and incidental items under the work of this section for all items indicated on the Drawings but not specifically addressed in other sections or not necessarily scheduled herein.

1.02 RELATED SECTIONS:

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.03 STANDARDS:

- A. Individual items or assemblies scheduled or as indicated on the Drawings, shall conform to respective industry and governmental standards.

1.04 QUALITY ASSURANCE:

- A. Installation of items or assemblies shall be by personnel thoroughly trained and experienced in the required skills and completely familiar with respective manufacturer's methods of installation.
- B. CBC, California Building Code - 2022 Edition, as amended.

1.05 SUBMITTALS:

- A. Before any specialty items are delivered to the job site, submit Shop Drawings and catalog cuts with product data in accordance with Division 0&1. Show all details of installation and assembly, all requirements for work by other trades, and all colors available from the selected manufacturer in the quality specified.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Deliver undamaged products or materials to site in manufacturer's sealed containers or wrappings with legends intact. Store on site secure from weather, soil and physical damage.

PART 2 – PRODUCTS

2.01 GENERAL:

- A. All items or assemblies shall be as scheduled in Article 3.05 of this Section, or approved equal items as set forth in Division 0&1, covering submission and review of substitutions.
- B. Items which are not scheduled herein and not addressed in other Sections, but are noted or otherwise indicated on the Drawings, will be clarified by the Architect prior to or after the Bid upon the Contractor's request. Such clarification will not be considered as grounds for an increase to the contract cost or to the contract time when such a clarification is requested after the Bid.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. Coordinate with other trades as required to ensure proper and adequate provision in framing and wall finish for the installation of the selected specialties in the correct locations.
- B. Prior to installation, carefully inspect and verify that the installed work of other trades is complete to the point where this installation may properly commence.
- C. Verify that specified items can be installed in accordance with the approved design.
- D. In the event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.
- E. Upon completion of installation, and as a condition of acceptance, visually inspect the entire work of this Section, adjust all components for proper alignment and use, and touch up all abrasions and scratches to make them completely invisible.

3.02 INSTALLATION:

- A. Install all specialty items where indicated on the Drawings and in full accordance with all pertinent regulations and the manufacturer's recommendations, anchoring all components firmly in place for long life under hard use.

3.03 PROTECTION:

- A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacements necessary to the satisfaction of the Architect at no additional cost to the Owner.

3.04 CLEAN UP:

- A. Keep building and premises free from accumulated waste materials, rubbish and debris resulting from Work herein. Upon completion of work, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from installation, and legally dispose of off site.

3.05 SCHEDULE OF MISCELLANEOUS SPECIALTIES:

- A. **Mini-Blinds:** Provide where located on the Drawings, 1" aluminum mini-blinds. Blinds shall be Simplelift lift control with a wanded tilt with 1" slat sizes. Color shall be chosen from the full line of manufacturers colors. See <https://www.hunterdouglas.com/window-treatments/blinds/metal-blinds/modern-precious-metals> for product information.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provision and installation of interior and exterior room and building identification signs, geometric restroom signs, individual raised letters, concrete casting letters, decals, interior and exterior directional and informational signs including signs for accessible features and regulatory signs and support posts

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 11 00: Metal Doors.
3. Section 08 14 00: Wood Doors.
4. Section 09 29 00: Gypsum Board.

1.02 REFERENCES

A. Accessible signs shall conform with the following requirements as indicated:

1. California Building Code (CBC) Title 24, 2022 Edition.
2. ADA Accessibility Guidelines (ADAAG, latest adopted edition).
3. Contracted Grade 2 Braille shall be used whenever Braille symbols are specifically required (CBC Section 11B-703.3 Braille).
4. Means of Egress Identification: CBC 11B-216.1 & 11B-703.1.
5. Tactile Exit Signs: CBC 1013.4.
6. Restroom Identification Symbols: CBC 11B-216.8 & 11B-703.7.2.6.
7. Signs and Identification: CBC 11B-216.1 & 11B-703.1.
8. International Symbol of Accessibility: CBC 11B-703.7.2.1.
9. Direction and Information Signs: CBC 11B-703.1.
10. Symbols of Accessibility: CBC 11B-703.7.
11. Finish and Contrast: CBC 11B-703.5.1.
12. Character Proportions: CBC 11B-703.2.4.
13. Character Height: CBC 11B-703.2.5.
14. Raised Characters and Pictorial Symbol Signs: CBC 11B-703.2 & 11B-703.6.
15. Braille: CBC 11B-703.3.
16. Mounting Height and Location: CBC 11B-703.4.1 & 11B-703.4.2.
17. Symbols of Accessibility: CBC 11B-703.7.2.
18. Color of Symbol: CBC 11B-703.7.2.1.
19. Entrance Signs: CBC 11B-216.6.

- B. ASTM D4802 - Standard Specification for Acrylic Plastic Sheet.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.

1.03 SUBMITTALS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Shop drawings listing sign types using the same sign type designations identified in the SIGNAGE SCHEDULES in this Section, lettering and locations and overall dimensions of each sign.
- C. Two (2) samples of typical room identification sign illustrating full size sample sign with tactile characters, Braille and subsurface text or pictogram to demonstrate fabrication technique and Braille measurements which shall be used on proposed project.
- D. Submit manufacturer's technical data and installation for each type of sign required.
- E. Submit samples of background colors, character colors, and one-inch high print outs of "I," "O" and "X" from proposed type styles. Indicate which type styles shall be used for required tactile characters and for required visual characters.
- F. Submit proposed sign schedule to comply with scoping requirements above and clearly identifying all sign types, locations and text. Architect will assist in clarifying room names at time of submittal.
 - 1. Sign type designations in submittal must match those in the SIGNAGE SCHEDULE in this Section.
- G. All signage shall be designed and constructed to comply with signage specifications and drawings.

1.04 QUALITY ASSURANCE

- A. Manufacturers shall have a minimum of five (5) years of documented experience in fabricating and installing both tactile and non-tactile signs and lettering required by this section.
 - 1. Manufacturer's Two-Year Warranties.
- B. Contractor shall provide labor and materials to repair or replace defective signs as directed by Owner during warranty period. Defects shall include:
 - 1. Tactile characters and/or Braille dots which come off or are easily removed.
 - 2. Discoloration, wear and scratching off of the surface color.
 - 3. All signs and sign components, except for damage by mishandling by Owner, including

installation by Owner, or vandalism.

C. Pre-installation Meeting

1. Notify Architect when signs are ready for installation. Arrange for conference at job site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.
- B. Manufacturers shall submit 3 references showing products for projects completed within the last 6 years. Both tactile and non-tactile signage shall be included in the work.
- C. Manufacture's Two-Year Warranties.
- D. Contractor shall provide labor and materials to repair or replace defective signs as directed by Owner. Defects shall include:
 1. Tactile characters and/or Braille dots which come off or are removed.
 2. Discoloration, wear and scratching off of the surface color.
 3. All signs and sign components, except for damage by mishandling by Owner, including installation by Owner, or vandalism.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products of following manufacturers form basis for design and quality intended.
 1. **Gravotech.** www.gravotech.com
 2. Or approved equal with direct compatibility with District-owned Gravotech engraving equipment and surplus engraving materials for sign types specified as "Modular".

2.02 MATERIALS

- A. **Modular Acrylic Framed Signs (Sign Types S-1 & S-3 per Signage Schedule below):**
 1. Modular sign panels mounted in permanently fixed frames with sign panels capable of being removed and replaced.
 2. ADA Tactile and Braille Signs: Sand-Carved signs; thermosetting high-pressure laminate using Graphic Process Sand-Carved signs, exterior-grade, graphics, Braille and tactile copy required. Square corners, square cut edges, matt finish using **Gravotac** sheet engraving materials as manufactured by Gravotech.

- a. Frame: Single-piece, square-edge modular plastic frames with concealed screw mounting by Gravotech. Color as selected by Architect at time of submittal.
- b. ADA TactManufacturer's standard process for producing copy complying with CBC and ADA Accessibility Guidelines. Text shall be accompanied by California Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks, permanently fused to substrate.
- c. Raised-Copy Thickness: Not less than 1/32 inch.

B. Non-Tactile, Non-Modular Signs (Sign Types S-4 & S-5 per Signage Schedule below):

1. Cast Acrylic Plastic Sheet; ASTM D4802 Category A-1, ¼ inch overall thickness, laminated acrylic plastic sheets, sub-surface screened process graphics and symbols, exterior-grade at exterior locations, square 3/8-inch radius corners, square cut edge, drilled holes for countersunk screws, polished edges.
 - a. Unframed Signs
2. Apply UV inhibitor overcoat for exterior signs.

C. Restroom Signs (Sign Type S2 per Signage Schedule below):

1. Staff Men and Staff Women, Girls, Boys and Gender Neutral Restroom Signage:
 - a. Doorways leading to these restrooms shall be identified by a combination of a ¼" matt finished colored acrylic polymer material with 12 inch diameter and equilateral triangle 1/4 inch thick raised acrylic with edges 12 inches long, with vertex pointing upward in contrasting color from door color. Sign shall be mounted in center of door 60 inches from finish floor to center of sign.
 - b. Room shall be further identified by rectangular colored acrylic polymer matt finished room identification sign ¼ inch thick, 8 inch height by 6 inch length minimum unless indicated on Drawings upon which appears gender appropriate pictogram 6 inches high, and the appropriate text in all CAPS immediately below on the same sign in contrasting color. Letters: 5/8 inches minimum and 2 inches maximum high in contrasting color, raised minimum 1/32 inch fully tactile, accompanied by the California Contracted Grade 2 Braille indicator immediately below. Sign shall be located on wall on latch side of door, 60 inches from finish floor to center of sign, centered horizontally within 18-inch space adjacent to latch side of door or on nearest adjacent wall.
 - c. Conform to all CBC requirements, CBC 11B.703.1 and 11B-703.7.2.6.1 (6.2 and 6.3).
 - d. See details on drawings for pictograms, text and other design criteria.

D. Exterior Site Signs (Sign Types S9 & S-10 per Signage Schedule below):

1. Material: 0.040 inch thick, Type 304 stainless steel or .080 aluminum. All exterior signs to have 0.125" rounded corner radius.
2. Finish: Non-glare (non-reflective) materials shall be used for all signs which identify, direct to, or give information about facilities and their use. Background and text/pictograms shall contrast a minimum of 70%.

- a. Exception: Parking, traffic signs, and exterior safety signs may use reflective materials. Identification signs for accessible parking spaces shall use reflective materials for graphics.
3. Accessible Parking Stall Sign (See Drawings for locations):
 - a. Fabricate with metal panel for each accessible parking stall as indicated on the Drawings. The sign shall display the International Symbol of Accessibility (reflectorized); text shall occur below the symbol and read "MINIMUM FINE \$250". The bottom of the regular accessible stall sign shall be mounted 80" above the finish grade. Color shall be white text on blue field. See Drawings for additional information.
 4. Van Accessible Parking Stall Sign (See Drawings for locations):
 - a. Same as "Accessible Parking Stall Sign" described above. Install above new "Van Accessible" sign. Color shall be white text on blue field. See Drawings for additional information.
 5. Accessible Parking Entry Sign (See Drawings for locations):
 - a. Fabricate with a single post and metal panel at location indicated on the Drawings. The sign shall display the text as described on the Drawings. The bottom of the regular accessible stall sign shall be mounted 80" above the finish grade. Color shall be white text on blue field. See Drawings for additional information.

E. Fasteners

1. One-way tamper resistant screw (1.25" minimum, 1" minimum embedment into wall) for wood, masonry or concrete application and self-drilling tamper resistant pan head pin in head Torx (1") for metal application with fastener anchors as appropriate for wall material. All exterior fasteners shall be stainless steel.
2. All interior and exterior signs or sign frames shall be set in full-bed of clear silicone sealant in addition to specified mechanical fasteners. Wipe all squeeze-out for clean appearance.

F. Lettering Type Style

1. All signage shall be **CALIBRI REGULAR**, uppercase letters only unless otherwise indicated for all sign types. Refer to 2.03, REGULATORY REQUIREMENTS FOR FABRICATION below for letter-proportion compliance.

2.03 REGULATORY REQUIREMENTS FOR FABRICATION

A. Fonts and Characters:

1. Numerals and uppercase letters on metal signs will be minimum 1 inch high (vertical dimension unless otherwise shown on Drawings) embossed text and numerals shall comply with CBC 11B-703.2 & 11B-703.6. Vertical dimension of lowercase letters shall be proportional to height of uppercase letters.

2. Raised tactile characters shall be raised 1/32 inch minimum and shall be San Serif uppercase and lowercase characters and numerals accompanied by corresponding California Grade 2 Contract Braille. See Section 2.01.C below.
 3. Raised tactile characters shall have beveled edges.
 4. Characters shall have a minimum of 70 percent contrast with their backgrounds on all signs which identify, direct to, or give information about facilities and their use.
 5. Characters on all signs which identify, direct to, or give information about facilities and their use shall comply with CBC 11B-703.2.4 & 11B-703.2.6.
 6. Type styles of characters on all signs which identify, direct to, or give information about facilities and their use shall not be italic, oblique, or decorative in style.
 7. Non-tactile characters (letters, numbers and symbols) shall be as identified on the Drawings.
 - a. Characters shall be a combination of upper and lowercase font.
 - b. Upper case letters shall be 1 inch high (unless otherwise shown on Drawings, maximum 1 1/4 inch high).
 - c. Height of lowercase letters shall be proportional to height of upper case letter.
 8. Tactile Characters
 - a. Characters required to be tactile shall be San Serif.
 - b. Characters shall be raised 1/32 inch minimum and a maximum of 1/16 inch from the background.
 - c. Characters shall be uppercase unless otherwise shown on Drawings. Signs shall have tactile characters where shown on Drawings.
 - d. Upper case tactile letters shall be 1 inch high (unless otherwise shown on Drawings, maximum 1-1/4 inch high).
 - e. Height of lowercase letters shall be proportional to height of uppercase letter.
 - f. A minimum of 1/8" space between the top surfaces of adjacent characters measuring between the two closest points shall be provided.
 9. Non-Tactile Graphics and Text
 - a. Non-tactile graphics/pictogram and text shall be screen printed on the surface and complying section.
 - b. Identifying pictograms shall be located above the tactile text in a clear, six inch high field.
 - c. Non-tactile text shall be upper case and one inch high (unless otherwise shown on Drawings), and shall comply with CBC 11B-703.2.4, 11B-703.2.6, 11B-703.5.1, 11B-703.5.4, 11B-703.5.5, & 11B-703.6.2.
- C. Braille:
1. Braille text shall comply with CBC 11B-703.3.
 2. Braille on metal signs shall be embossed domed California Contracted Grade 2 Braille. All Braille shall be fabricated by a method which produces a rounded or domed dot shape. All Braille dots shall be solid or filled from behind so they cannot be crushed or indented.
 3. Braille dot, cell spacing and dot height shall follow specifications as per CBC11B-703.3 &

11B-703.3.1.

4. There shall be no Braille indication of capital letters except for proper names, individual letters or acronyms, or beginnings of sentences.
5. Braille shall be centered directly below raised print characters.
6. Braille shall be located on the sign $\frac{3}{8}$ to $\frac{1}{2}$ inch below the corresponding tactile characters, flush left or centered to the characters depending on the sign layout. (CBC 11B-703.2.9 & 11B-703.3.2).

- D. Polish sign panel edges to remove all fabrication burrs and sharp edges.
- E. See drawings for additional information.

2.03 SIGN TYPE SCHEDULE: (See Drawings for locations and additional design and mounting criteria not specified herein. Most signs are scheduled from the Opening Schedules on the Drawings. Additional signs are identified on site plans, floor plans and building elevations with keynotes. Actual colors and final text will be verified by the Architect during the submittal process.)

A. Type S-1, STANDARD INTERIOR & EXTERIOR ROOM IDENTIFICATION (Modular Acrylic/Framed):

1. Acrylic polymer sign panel fabricated per regulatory requirements identified in this section.
2. Where sign is mounted to glass, provide heavy-duty vinyl decal to back side of glass in same size as sign to obscure view of back of ID sign and adhesive. Decal shall have $\frac{1}{4}$ " rounded corners with color to be selected by Architect at time of submittal.

B. Type S-2, STUDENT & STAFF RESTROOM DOOR AND SIDE WALL:

1. Acrylic polymer door and wall sign panels fabricated per regulatory requirements identified in this section.
2. Text and graphic symbols as specified herein and as indicated on the drawings.

F. Type S-4, ASSISTIVE LISTENING DEVICE:

1. Acrylic polymer sign panel fabricated per regulatory requirements identified in this section.

L. Type S-10, SITE PARKING AND DIRECTIONAL SIGNS:

1. Signs include stop signs, accessible site entry sign, accessible and EVC stall signs and other site related parking, directional and regulatory signs. See drawings for additional information.
2. Unless otherwise indicated, signs shall be made from .080 minimum aluminum sheet material and shall have minimum 0.125 inch rounded corner radius and reflectorized finishes.
3. See drawings for pole and footing details.
4. See drawings for text, graphics and other design information.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are complete and ready to receive Work.

- B. Beginning of installation means installer accepts existing surfaces.

3.01 INSTALLATION

- A. Signs shall be installed with edges horizontal and vertical and face plumb.
- B. Screw length shall be sufficient for minimum 1-inch embedment.
- C. Permanent identification signs for rooms or spaces shall be installed on the wall or glazed side-lite adjacent to the latch side of the door unless otherwise indicated on the drawings.
- D. Sign Mounting
 - 1. Mounting Height and Location:
 - a. Signs with raised characters and Braille shall be located 48 inches minimum to the baseline of the lowest line of Braille cells and 60 inches maximum to the baseline of the highest line of raised characters above the finish floor or ground surfaces. Mounting location shall be located so that a clear space of 18 inch minimum by minimum by 18 inch minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45-degree open position. CBC Section 11B-703.4.
 - b. Non-tactile/non-Braille signs shall be located as indicated on the drawings or as otherwise directed during installation.
 - 2. Framed & Unframed Plastic Signs:
 - a. Install with clear silicone adhesive, with zero clearance between plastic and face of substrate. Double face adhesive tape not permitted.
 - b. Additionally, Install with stainless steel countersunk flathead screws, pin torx, vandal-proof in each corner of sign or as otherwise shown on drawings for non-rectangular restroom signs. Pre-drill holes to prevent breaking plastic, use countersunk drill bits to flush screw head with sign surface.
 - 3. Metal Signs:
 - a. Install with four (4) flathead countersunk No. 8 stainless steel vandal-proof screws at pre-drilled holes, top of screw heads shall flush with sign surface, concealed mounting.
 - b. All metal site signs shall be mounted with bottom at 6'-8" above adjacent finish grade unless otherwise indicated on the drawings.
 - 4. Signs mounted onto glass:
 - a. Sign shall be securely attached to glass with full bed of clear silicone sealant. Wipe squeeze-out clean. Do not use double-stick tape.
 - b. Where interior and exterior signs are to be mounted back-to-back, signs shall be the same size (the larger sign size shall dictate the size of the smaller sign) and located back-to-back.

- c. At locations where signs are applied to glass and without a corresponding sign on the back side, provide matte finished heavy-gauge vinyl decal on opposite side of glass from sign to conceal back of sign and adhesive anchors. Decal shall have ¼" rounded corners and be same size, shape and color of base sign.
- E. The Contractor is solely responsible for the identification of the material onto which signs are to be mounted. The Contractor shall furnish and install all materials necessary for the proper installation of each sign.
- F. Clean and polish.

3.02 ADJUST AND CLEAN

- A. Clean and Touch-up: Remove all packing and protection blemishes and thoroughly clean and polish all finish surfaces. Restore any marred or abraded surfaces to their original condition by touching up in accordance with the manufacturer's recommendations. Touch-up shall not be obvious.
- B. Defective Work: Remove and replace all defective work which cannot be properly repaired, cleaned or touched-up with no additional cost to the owner.
- C. Protect installed work during the construction period to prevent abuse and damage.

3.03 CLEAN-UP

- A. Upon completion of the work of this section, remove all surplus materials, rubbish and debris from the premises.

3.04 FIELD QUALITY CONTROL

- A. DSA Inspections: Signs and identifications or other information shall be field inspected after installation and approved by Division of the State Architect prior to the issuance of a final certificate of occupancy, or final approval where no certificate of occupancy is issued. The inspection shall include, but not limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with CBC, Section 11B-703.1.1.2.

END OF SECTION 10 14 00

SECTION 10 21 13

TOILET COMPARTMENTS AND CUBICLES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Toilet Compartments.
2. Urinal Screens.
3. Shower Dividers.
4. Dressing Compartments.

B. Related Sections

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 06 10 00 – Rough Carpentry.
3. Section 03 30 00 – Cast-In-Place Concrete.
4. Section 05 50 00 – Metal Fabrications
5. Section 10 28 00 - Washroom Accessories.

1.02 REFERENCES

- A. National Fire Protection Association 101 Life Safety Code, Chapters 5, 6, 8-30.
- B. ANSI A117.1: Accessible and Usable Buildings And Facilities.
- C. Title 24, California Code of Regulations, Parts 2, 3, and 5.
- D. ADA, Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 144, Rules and Regulations.
- E. US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Program.
- F. American Society for Testing and Materials Standards:
 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 2. ASTM D2794 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 3. ASTM D2197 Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
 4. ASTM D6578 Standard Practice for Determination of Graffiti Resistance.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements

1. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, "Graffiti Removal Procedure Using Manual Solvent Rubs":
 - a. Cleanability: Five (5) required staining agents shall be cleaned off material.
2. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197-98(2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:
 - a. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.
3. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2794-93(1999)e1 Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625" hemispherical indenter with 2-lb impact weight:
 - a. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.
4. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
 - a. Smoke Developed Index: Not to exceed 450.
 - b. Flame Spread Index: Not to exceed 75.
 - c. Material Fire Ratings:
 - 1) National Fire Protection Association (NFPA): Class B.
 - 2) International Code Council (ICC): Class B.

1.04 SUBMITTALS

A. Comply with requirements of Section 01 33 00.

B. Manufacturer's Data.

1. Provide required number copies of:
 - a. Product data sheets.
 - b. Installation instructions.
 - c. Cleaning and maintenance instructions.
 - d. Replacement parts information.

C. Shop Drawings.

1. Provide required number of copies of all shop drawings.
2. Show fabrication and erection of compartment assemblies, to extent not fully described by manufacturer's data sheets.
3. Show anchorage, accessory items and finishes.

4. Provide location drawings for bolt hole locations in supporting members for attachment of compartments.
- D. Samples.
1. Furnish scale model of compartments, including stile, shoe, door, door hardware, divider panel, and mounting brackets.
 2. Furnish sections showing stile anchoring and leveling devices, concealed threaded inserts, panel, stile, and edge construction.
- 1.06 DELIVERY, STORAGE, AND HANDLING
- A. Deliver items in manufacturer's original unopened protective packaging.
 - B. Store materials in original protective packaging to prevent physical damage or wetting.
 - C. Handle so as to prevent damage to finished surfaces.
- 1.07 WARRANTY
- A. Furnish ten-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.
 - B. Furnish one-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.
- 1.08 ATTIC STOCK
- A. Provide two additional latches and associated hardware per toilet room included in scope of work.
 - B. Provide one additional 12-inch-wide stile per toilet room included in scope of work.
 - C. Provide one additional 36-inch-wide stall door per toilet room included in scope of work.

PART 2 - PRODUCTS

2.01 MANUFACTURER (DISTRICT STANDARD)

- A. Model numbers for toilet partitions manufactured by Bobrick Washroom Equipment, Inc., represented by R. E. Edwards & Associates (925-829-2942), are listed to establish a standard of quality for design, function, materials, workmanship, and appearance. Other manufacturers may be submitted for evaluation by the architect by following the conditions of the substitutions clause. Unless approval is obtained ten days prior to the bid date, all bids shall be based on the standard of quality. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

- B. Toilet partitions shall be the product(s) of a single manufacturer.

2.02 MOUNTING CONFIGURATIONS

- A. Toilet Partitions/Shower Dividers/Dressing Compartments shall be:

- 1. Overhead-Braced (1092.67 Sierra™ Series)

- B. Urinal Screens shall be:

- 1. Floor-Anchored (1091 Sierra Series):

- or -

- Post-to-Ceiling (1093 Sierra Series)

- or -

- Wall-Hung (1095 Sierra Series)

2.03 COMPONENTS/MATERIALS

- A. Stiles, Panels, Doors, and Screens shall be all be manufactured from Solid Color Reinforced Composite material.

- B. Toilet Partition Material

- 1. Toilet partitions shall be constructed of Solid Color Reinforced Composite material, which is composed of dyes, organic fibrous material, and polycarbonate/phenolic resins. Material shall have a non-ghosting, graffiti-resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.
- 2. Subject to compliance with the material performance requirements, toilet partitions manufactured by others may be constructed from Solid Surface materials including, but not limited to:
 - a. Dupont Corian Privacy Plus Partitions.
 - b. WilsonArt Solid Surface.
- 3. Toilet partitions constructed of High-Density Polyethylene (HDPE) or High-Density Polypropylene will not be acceptable.

- C. Finish Thickness

- 1. Stiles and doors shall be 3/4" (19 mm).
- 2. Panels and benches shall be 1/2" (13 mm).

- D. Hardware

- 1. All hardware shall be Bobrick "1092.67DS Optional Institutional Hardware". Where Specifications and/or Drawings conflict with Bobrick "1092.67 Optional Institutional Hardware" requirements, the Bobrick "1092.67 Optional Institutional Hardware" requirements shall prevail.

2. Provide optional Door Plate Bobrick Part No. 1002510 at top and bottom of each partition door.
3. All hardware to be 18-8, type-304 stainless steel with satin finish.
4. Hardware of chrome-plated "Zamak", aluminum, or plastic is unacceptable.

E. Latch

1. Sliding door latch shall be 14 gauge (2 mm) and shall slide on nylon track.
2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.
3. Latch track shall be attached to door by machine screws into factory-installed threaded brass inserts.
4. Threaded brass inserts shall be factory installed for door hinge and latch connections and shall withstand a direct pull exceeding 1,500 lbs. per insert.
5. Through bolted, stainless steel, pin-in-head Torx sex bolt fasteners shall be used at latch keeper-to-stile connections and shall withstand direct pull force exceeding 1,500 lbs. per fastener.

F. Hinges

1. Hinge shall be 16-gauge (1.6-mm) continuous piano hinge.
2. All doors shall be equipped with self-closing hinge.
3. Continuous piano hinge shall be attached to door and stile by theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts
4. Fasteners secured directly into the core are not acceptable.
5. Door shall be furnished with two 11-gauge (3-mm) stainless steel door stop plates with attached rubber bumpers to resist door from being kicked in/out beyond stile.
6. Door stops and hinges shall be secured with stainless steel, pin-in-head Torx machine screws into threaded brass inserts.
7. Threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per insert.

G. Mounting Bracket

1. Mounting brackets shall be 18-gauge (1.2- mm) stainless steel and extend full height of panel.
2. U-channels shall be furnished to secure panels to stiles.
3. Angle brackets shall be furnished to secure stiles to walls and panels to walls.
4. Fasteners at locations connecting panels-to-stiles shall utilize through bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Through-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.
5. Wall mounted urinal screen brackets shall be 11 gauge (3 mm) double thickness.

H. Leveling Device shall be 7-gauge, 3/16" (5-mm) hot rolled steel bar; chromate-treated and zinc-plated; through-bolted to base of solid color reinforced composite stile.

I. Stile Shoe shall be one-piece, 4" (102-mm) high, type-304, 22-gauge (0.8-mm) stainless steel with satin finish. Top shall have 90° return to stile. Shoe will be composed of one-piece of stainless steel and capable of being fastened (by clip) to stiles starting at wall line.

- J. Headrail (Overhead Braced) shall be satin finish, extruded anodized aluminum (.125" / 3-mm thick) with anti-grip profile.
- K. Full-Height Post: At all partition panels over 5'-0" in unsupported length, and at free ends of urinal screens, provide a full-height 1-1/4"x1-1/4" stainless-steel post, Bobrick Part No. 1000070 and Anchor Package Part No. 1002703. Provide floor and ceiling saddles. Fasteners into concrete floor shall be stainless steel. The panel shall be anchored to post to help eliminate side to side flex of the panel.
- L. Grab Bar Anchors for Toilet Partitions: At all locations as shown on drawings where grab bars are mounted on partition system, provide Bobrick 2586 Series stainless steel backing plate.
- G. Coat Hook
 - 1. Coat Hook shall Bobrick Model B-233 and be constructed of stainless steel and shall project no more than 1-1/8" (29 mm) from face of door.
 - 2. Coat hook shall be secured by to door by through-bolted, theft-resistant, pin-in-head Torx stainless steel screws. Through-bolted fasteners shall withstand a direct pull force exceeding 1,500 lbs. per fastener.
 - 3. Coat Hook shall act as door bumper on in-swing doors.
 - 4. Mounting height = 48" maximum above finished floor.
- H. Door Pull: Accessible stall door shall have a compliant loop or U-shaped door pull on inside and outside of door immediately below latch.
- I. Door Bumpers: Provide wall door bumper for all doors where partition door will impact wall finish. Wall bumper shall be equal to Trimco, Model No. 1270CVPV. Mount on wall at height to match partition door handle.

2.04 FABRICATION

- A. Vandal-Resistant Hardware Option: for Institutional Hardware option add suffix .67 to 1092 Series.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
- B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- C. Do not begin installation of compartments until conditions are satisfactory.

3.02 ERECTION

- A. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.
- B. Installation methods shall conform to manufacturer's recommendation for backing and proper support.
- C. Conceal evidence of drilling, cutting, and fitting to room finish.
- D. Maintain uniform clearance at vertical edge of doors.
- F. Attach panel brackets securely to walls using anchor devices. All anchors shall be into solid wood blocking. No plastic expansion sleeves will be accepted.
- G. Attach panels and pilasters to bracket with through-sleeve tamperproof bolts and nuts.
- H. Anchor urinal screen panels to walls with continuous panel brackets. At free end, provide full-height post as noted in Paragraph 2.03-K.
- I. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- J. Equip each door with one hinge, one door latch, and one coat hook and bumper.
- K. Install door strike and keeper with door bumper on each pilaster in alignment with door latch.
- L. Adjust hinges to locate doors in partial opening position when unlatched. Return outswing doors to close position.
- M. Contractor shall install backing/blocking as required for secure attachment.
- N. Confirm all locations of full-height post and provide blocking in ceiling space. Contractor shall open ceiling as required to install 4x4 blocking for attachment of post.
- O. At locations of grab bars mounted on partition system, Contractor shall carefully measure and drill panels for grab bar anchors.
- P. Where full-height stainless steel brackets extend above ceramic tile wainscot, provide plywood shim between wall and bracket to act as spacer. Shim shall be narrower than brackets to allow for sealant joint. After shim installation, provide sealant joint between wall and bracket to completely enclose edge of plywood.

3.03 ADJUSTMENT AND CLEANING

- A. Adjust hardware for proper operation after installation.
- B. Set hinge cam on in-swinging doors to hold doors open when unlatched.

- C. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- D. Clean exposed surfaces of compartments, hardware, and fittings.
- E. Remove protective maskings. Clean surfaces.
- F. Field touch-up of scratches or damaged enamel finish will not be permitted.
- G. Replace damaged or scratched materials with new materials.

END OF SECTION

SECTION 10 26 33
FIBERGLASS REINFORCED LAMINATE PANELS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Manufacturer’s standard and custom-image FRL (Fiber Reinforced Laminate) wall protection panels for wall installation.
 - 2. Accessories, including trims, adhesives and sealants.

- B. Related Sections: Coordinate with work of other sections including the following:
 - 1. Section 09 21 16: Gypsum Board.
 - 2. Section 09 65 16: Resilient Flooring and Base.

1.02 SCOPE:

- A. Provide all standard and custom-image wall protective panels complete with all trim pieces at staff single accommodation toilet rooms, specified here, and needed for a complete and proper installation.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer’s literature including product characteristics, accessories and limitations.

- B. Selection Samples: Submit samples of colors and finishes if requested by architect.

- C. Verification Samples of Custom FRL Panels: Submit samples of materials selected with portion of actual digital graphic to verify image, colors and finish.

- D. Industry Certifications and Standards: Submit copy of documentation indicating compliance.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Minimum of 5-years experience manufacturing similar products.

1.05 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.

1.06 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty against defects in manufacturing.

PART 2 – PRODUCTS

2.01 STANDARD FIBER REINFORCED LAMINATE PANELS (FRL-1):

- A. Basis-of-Design Manufacturer: **Panolam Surface Systems, Inc.**, One Corporate Drive, Suite 725, Shelton, CT 06484. Tel: 203-925-1556. Web: www.panolam.com. (Specified). Panels shall comply with the following minimum requirements:
1. Thickness: 0.075 inches.
 2. Panel Size: 4'-0" min. width x 8' -0" high (10' high as required to avoid horizontal seams).
 3. Color: As selected by Architect at time of submittal from manufacturer's full range of Nevamar or Pionite colors, patterns and textures.
 4. Finish: As selected by Architect at time of submittal from manufacturer's full range of standard finish options.
 5. Surface Burning Characteristics: US Standard UL-723/ASTM E 84 Class A; Canadian Standard ULC-S102 Class A for Surface Burning Characteristics of Building Materials.
 6. Sustainability, Indoor Air Quality: GREENGUARD Gold Certification.
 7. IMO Certified for marine use.
 8. Chemical resistant compliant with SEFA 8 requirements.
 9. Wear Resistance (Cycles) NEMA 3.13: 3500 typical.
 10. Flexural Strength ASTM D790: 20,148 psi typical.
 11. Molding Profiles: Outside corners flat, outside corners round, division bars, inside corners, standard end caps.
 12. Adhesive: Construction Adhesive #4319 by Franklin Adhesives and Polymers or equal approved by panel manufacturer.
 13. Joint Caulking: Color Sil by Color Rite or equal approved by panel manufacturer; 100 percent silicone based colored caulking.
- B. Approved equal meeting all specified requirements herein.

PART 3 – EXECUTION

3.01 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. Gypsum board wall surfaces scheduled to receive FRL panels shall be finished to a Level 5 finish per Specification Section 90 29 00.

3.02 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals.
 - 1. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation. The wall must be finished to level 3 and fully primed.
 - 2. Install panels with bottom edge located to clear top of any rigid wall base. Rubber wall bases may be bonded over the FRL panels using a polymer or urethane based adhesive.
 - 3. Apply adhesive uniformly using adhesive manufacturers recommended notched trowel to the entire back of panels completely to the edge.
 - 4. Lay FRL panels in place leaving approximately 1/8 inch vertical installations 3/16 inch for horizontal installations between panel joints.
 - 5. Follow adhesive manufacturer's recommendations for set and application times.
 - 6. If you are attaching FRL panels to a door or wood substrate, we recommend the use of contact glue. Please follow contact glue manufacturer's directions.
 - 7. Apply pressure to entire panel face with laminate type roller, removing trapped air and ensure proper adhesion between surfaces.
 - 8. If no trim is used, seal panel joints and top, side, and bottom edges with colored 100% silicone caulking to match panel color. Wipe smooth and remove excess caulk from FRL panel face.

3.03 ADJUSTING AND CLEANING

- A. Replace installations 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 10 26 33

SECTION 10 28 00

TOILET, BATH, AND WASHROOM ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Toilet and bath, shower, and washroom accessories.
2. Framed mirror units.
3. Concealed anchor devices and backing plate reinforcements furnished to other Sections.
4. Attachment hardware.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 09 29 00: Gypsum Board.
3. Section 10 21 13: Toilet Compartments and Cubicles.

1.02 REFERENCES

- A. ADAAG - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.
- B. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- C. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- E. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.03 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00. Provide product data on accessories describing size, finish, details of function, attachment methods.
- C. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements

1. Conform to CBC, California Building Code, (CCR) Title 24, Part 2, and ADAAG or accessibility requirements.
2. Structural strength of grab bars, shower seats, fasteners and mounting devices shall conform to requirements of the CBC, California Building Code, (CCR) Title 24, Part 2, Section 1115B.8.3 and shall withstand the application of a 250 lb. point load.

B. Coordination

1. Coordinate the work of this Section under provisions of Section 01 31 00.
2. Coordinate the work of this Section with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Bobrick Washroom Equipment, Inc., www.bobrick.com. (District standard)
- B. American Specialties, Inc. (ASI), www.americanspecialties.com.
- C. Bradley Corporation, www.bradleycorp.com.
- D. Deb.
- E. EXCEL Dryer.
- F. TORK.
- G. Substitutions: Under provisions of Section 01 33 00.

2.02 MATERIALS

- A. Sheet Steel.
- B. Stainless Steel Sheet: Type 304.
- C. Tubing: ASTM A269, stainless steel, Type 304.
- D. Adhesive: Two component epoxy type waterproof.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamperproof.

- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.
- E. Shop assemble components and package complete with anchors and fittings.
- F. Provide steel anchor plates, adapters, and anchor components for installation:
- G. Hot dip galvanize exposed and painted ferrous metal and fastening devices.
- H. Toilet tissue dispensers located in accessible toilet rooms or stalls shall not have their flow restricted and shall be capable of continuous flow.

2.04 FINISHES

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.
- D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- E. Stainless Steel: No. 4 satin luster finish.
- F. Mirror Glass: FS DD-G-451 Type I, Class 1, Quality of 2, 1/4 inch thick with silver coating, copper protective coating and non-metallic paint coating complying with FS DD-M-411.
- G. Stainless Steel Mirror: Type 430, 20 gage, bright annealed stainless steel.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions are ready to receive work and dimensions are as instructed by the manufacturer.

- B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

3.03 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Accessories required to be accessible shall be mounted at heights according to CBC Section 1115B.9 and as indicated on the drawings.
- D. Toilet paper dispensers and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished surface of the wall nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar.
- E. Contractor shall install all necessary blocking, backing, and recessed openings for all toilet accessories.
- F. At locations where grab bars are mounted to toilet partition material, provide optional anchor device, Bobrick #2586 at each flange.
- G. Toilet Seat Cover Dispensers: Provide at staff toilet rooms or stalls, and at gender neutral toilet rooms only. Do not provide at student toilet rooms or stalls.
- H. Sanitary Napkin Disposal: Provide at staff toilet rooms or stalls, at gender neutral toilet rooms, high school girls toilet rooms, and middle school girls toilet rooms.
- I. Hand Dryers: Extend power to location of hand dryer and provide necessary backbox for connection. Provide in-wall blocking for unit support.
- J. Keying Accessories
 - 1. Supply two keys for each accessory to Owner.
 - 2. Master key all accessories.

3.04 SCHEDULE

A. Grab bars	B-6808	Length as required
B. Toilet Paper Dispenser	B-2888	Surface mount
C. Toilet Paper Dispenser	B-3888	Semi-recessed
D. Feminine Napkin Disposal	B-270	Surface mount
E. Feminine Napkin Dispenser	B-2706	Surface Mount for modernization projects
F. Feminine Napkin Dispenser	B-3706	Semi-Recessed for new construction projects
G. Soap Dispenser	#91628	Black Proline Curve Dispenser Green Tip
H. Soap Dispenser Foam Soap	#32084	SC Johnson Professional Stoko Refresh 800ml Refill
I. Electric Hand Dryer	#XL-W	XLERATOR, 120V. Provide at multi-use toilet rooms
J. Hand Dryer Recess Kit	#40502	ADA-Compliant Recess Kit
K. Hand Dryer Wall Guard	#89S	Stainless Steel
J. Paper Towel Dispenser	#5510282	Tork Matic. Provide at staff toilets & clsrn. sinks
K. Mirror(non-tilt)	B-290	Minimum size 18 inches x 36 inches
L. Toilet Seat Cover Dispenser	B-221	Provide at staff toilet rooms

END OF SECTION

SECTION 10 75 16

GROUND-SET FLAGPOLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 0 Specification sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Aluminum flagpoles.
- B. Flags.

1.03 SUBMITTALS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Product Data: For each type of flagpole indicated. Include installation instructions and recommended foundation design.
- C. Closeout Submittals
 - 1. O & M Manuals: Maintenance and cleaning instructions
 - 2. Guarantee: Provide in complete form per Division 0, General Conditions.
- D. Shop Drawings: Submit complete shop drawings for all materials or furnishings requiring field or shop fabrication.

1.04 QUALITY ASSURANCE

- A. Review: All equipment shall be reviewed for conformance with the intent of the Contract Documents and accepted by the contractor prior to installation. All components shall be in a new, "first-class" condition, per the discretion of the District's Representative, prior to Final Acceptance.
- B. Source Limitations: Obtain each flagpole as a complete unit, including fitting, accessories, bases, and anchorage devices, from a single manufacturer.
- C. Integrated lighting shall be considered as part of an integral system from a single manufacturer.

1.05 GUARANTEE

- A. Provide in required form for a period of 1 year from date of acceptance by Owner.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store and handle acceptable to the District's Representative and so that work or access of others is not impeded.
- B. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 – PRODUCTS

2.01 FLAGPOLES

- A. General: Manufacturer's standard tapered aluminum flagpole, with all hardware, accessories, trim pieces, footing and anchorage for a complete, finished installation.
- B. Acceptable products:
 - a. Item Number ESR35D72-AA as manufactured by Colonial Flag.
1-877-941-3524.
www.colonialflag.com
 - b. Height: 34'-11".
 - c. STARGAZER LED Downlight/Internal-External Truck Combo as manufactured by Eagle Mountain Flag. External revolving truck. Provide separate wall mount power supply. Provide dusk-to-dawn photocell.
 - d. No known equals exist with integral lighting. Products with integral lighting will be considered for substitution per the requirements of Division 1, General Conditions.
- C. Alternate Products: Proposed equals are subject to the substitution process per applicable Sections of Division 1, General Requirements. Alternate products may be submitted as substitution requests. However, it is the Contractor's responsibility to prove that it is an "or equal" product, and the District Representative shall be the final authority.
- D. Accessories: Manufacturer's standard gold anodized aluminum top finial ball, single-sheave cast aluminum truck, No. 10 braided polypropylene rope halyard, tapered 6063-T6 aluminum alloy tube, lockable hasp box, spun aluminum flashing collar and ground set tube.
- E. Finishes:

- a. Manufacturer's clear anodized finish on all surfaces.
- b. Seal aluminum surfaces with clear, hard-coat wax.

F. Concrete: Refer to Section 32 16 00.

2.02 FLAGS

- A. Provide (1) one each American Flag and California State Flag. Flags shall be 5' x 8', 100% nylon fiber, with individually sewn and embroidered stripes, stars and graphics. Edges shall be fully hemmed and sewn with brass grommets at hanging end.

PART 3 – EXECUTION

3.01 SEQUENCING AND SCHEDULING

- A. Coordinate construction timing of installation in conformance with all other work.

3.02 INSTALLATION

- A. Concrete Footings: Install as shown in Drawings.
- B. Equipment: Conform to layout shown on Drawings. Install all components in strict conformance with referenced Standards, Details, accepted Shop Drawings, and manufacturer's instructions.
- C. Provide underground pathway from building to power supply, and from power supply to flagpole. Mount separate photocell at location recommended by manufacturer.

3.03 CLEANING

- A. Keep premises free from accumulation of waste and debris. At completion of installation remove all debris and clean adjacent surfaces as required.
- B. At completion clean exposed surfaces in a manner that will not damage finish.

[END OF SECTION 10 75 16]

SECTION 11 40 00
FOODSERVICE EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section includes furnishing all labor and material required to provide and deliver all Food Service Equipment herein specified into the building, uncrate, assemble, set-in-place, level and completely install, exclusive of final utility connections.
- B. Furnish all material and labor required to completely provide, deliver and install all Food Service Equipment as specified herein and as shown on the drawings. This work shall be in strict accordance with the plans and specifications with all dimensions verified in the field prior to any fabrication.
 - 1. Coordinate the Food Service Equipment work with the respective trades performing preparatory work for the installation of the Food Service Equipment.
 - 2. Comply with all Federal, State and Municipal regulations which bear on the execution of this project. Food Service aisles shall be a minimum of 36" wide and tray slides shall be mounted at 34" maximum above the finished floor.
- C. WORK INCLUDES:
 - 1. Materials shown on the Food Service Equipment Schedule.
 - 2. Piping, valves, and plumbing accessories that are integral within the equipment.
 - 3. Furnishing control devices such as solenoid valves that are not integral with the equipment, for installation by Mechanical Division 15 and/or Electrical Division 16.
 - 4. Wiring, wiring devices, controls and mechanical accessories that are integral in the equipment.
 - 5. Ventilating ducts, flues, controls and mechanical accessories that are integral in the equipment.

6. Anchors, fasteners, fillers and sealants for mounting equipment securely in place.
7. Cooperation with all other contractors on the job including the furnishing of information in the form of drawings, wiring diagrams and other data.
8. Touch-up painting after the installation of the Food Service Equipment.

D. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. Mechanical
2. Electrical

1.03 QUALITY ASSURANCE

A. QUALIFICATIONS:

1. Installer: Regularly engaged in providing Food Service Equipment from manufacturers of this type of equipment a minimum of five (5) years with at least five (5) installations of this size and type that are at least each three (3) years old.

B. STANDARD OF MANUFACTURE

1. Food Service Equipment that is specified as "custom" having no manufacture name or model number shall be manufactured by a Food Service Equipment Fabricator with at least five (5) years of experience with engineering, design and fabrication of Food Service Equipment. The manufacture shall be subject to the review of the Architect and/or Consultant and shall be approved by the National Sanitation Foundation. All fabricated equipment shall be constructed in strict compliance with the latest standards of the National Sanitation Foundation and shall bear the mark of the National Sanitation Foundation in full compliance with all applicable codes and ordinances.
2. All electrically heated or operated equipment shall bear the seal of approval of the Under Writers Laboratories and shall comply with the National Electrical Code and all local Codes and Ordinances.
3. All Food Service Equipment that is specified as "buy-out" having a specific manufacture name and model number shall comply with the latest editions of the National Sanitation Foundation.
4. All gas-heated or operated equipment shall bear the seal of approval of the American Gas Association (AGA).
5. All steam heated, or operated equipment shall conform to the standard of the American Society of Mechanical Engineers (ASME) and shall be ASME approved.

6. Food shields and sneeze guards shall meet all the requirements of National Sanitation Foundation (NSF) Standard 2.

1.04 SUBMITTALS

A. SHOP DRAWINGS / EQUIPMENT BROCHURES

1. No ordering or fabrication of equipment shall take place until such time as the Equipment Brochures and Shop Drawings have been reviewed in writing by the Architect and/or Consultant. Receipt of this review shall not relieve the Contractor from the responsibility of verifying all quantities and related dimensions, maintaining the specified quality of equipment, and verifying conditions of the job site.
2. Equipment Brochures; within twenty (20) calendar days after award of the contract, submittals in the form of PDF containing Manufacturers specification sheets, dimensioned drawings and/or other pertinent data describing all items of standard manufacture shall be submitted for review by the Architect and/or Consultant. Sheets with the notation "Fabricated Item" and name of the fabricated item, as well as any required mechanical, plumbing or electrical requirements shall be inserted between the Manufacturer's specification sheets describing the "buy-out" equipment; thus, giving a complete Brochure with all times accounted for. These Brochures shall have hard white covers with clear transparent overlays and locking rings. The name of the Contractor, Architect, Consultant and project clearly identified in large readable type. Failure to provide Brochures in the manner as described above will be cause for rejection of said brochures.
3. Rough-in and Equipment Location Drawings; within thirty (30) calendar days after award of the contract, submittals in the form of PDF, complete rough-in and details, electrical and plumbing services with both vertical and horizontal dimensions, from column center-lines or exterior walls for location said connection points and rough-in locations shall be submitted for review by the Architect and/or Consultant. Equipment location plans shall be drawn to scale of not less than $1/4" = 1'-0"$ and include a schedule of equipment clearly identifying all items. Minimum drawings size shall be 24"x 36".
4. Shop Drawings; within thirty (30) calendar days after award of the contract, submittals in the form of PDF of shop fabrication drawings shall be submitted for review by the Architect and/or Consultant. Plans shall be drawn to scale of not less than $1/2"=1'-0"$. Additional plan views, elevations and sections at $3/4"=1'-0"$ shall be supplied of all counters and tables with complete dimensions. All shop practices regarding joints, gussets, bracing, tie-downs, supports, etc. shall be clearly defined as well as gauges and quality of metals and brands and model numbers of all miscellaneous fittings, plumbing and electrical trim. The drawings shall also show locations of blocking (supplied under another sections) for all wall and ceiling mounted Food Service Equipment. Minimum drawings size shall be 24"x36".

B. SAMPLES

1. Provide all samples if specification requested.

C. SUBSTITUTIONS:

1. Manufacturer's listed in this section are used as standards for quality. All substitutions shall be approved by the Architect and/or Consultant prior to installation.
2. Refer to Division 1 - General Requirements for procedures governing substitutions.
3. Only one substitution for each item will be considered.
4. Installation of any qualified substituted equipment is the Food Service Equipment Contractor's responsibility. Including any mechanical, electrical, structural changes required for the installation of qualified substitution shall be without additional cost to the Owner.

D. DEFERRED APPROVAL ITEMS:

1. For the items identified on the Equipment List as (Deferred Approval Item), the following submittal requirements shall be provided:
 - a. Product data.
 - b. Manufacturer's recommended methods of installation coordinated with actual field conditions for anchorage to actual substrate conditions.
 - c. Shop Drawings: Indicate types, sections, gages, materials, completely dimensioned layouts and configurations, hardware, fasteners, operators and shop finishes and other required coatings. Provide calculations for all required connections.
 - d. Structural calculations, detail drawings, and all additional necessary drawings and specifications for a deferred approval shall be signed by a Structural Engineer licensed in the State of California.
 - e. Provide a copy of the Installer's Certification and a copy of the Manufacturer's written certification criteria. Provide list of a minimum of (5) five jobs installed by Installation Company with contact phone numbers of both the project's General Contractor and Owner.

1.05 DISCREPANCIES

- A. In the event of discrepancies within the Contract Documents, the Architect and/or Consultant shall be so notified within sufficient time prior to bid opening, ten (10) days to allow issuance of an addendum.

- B. In the event where time does not permit notification or clarification of discrepancies prior to the bid opening, the following shall apply: The drawings and drawing schedules shall govern in matters of quantity; the specifications in matter of quality. In the event of conflict within drawings involving quantities, or within the specifications involving quality, the greater quantity and high quality shall apply. Such discrepancies shall be noted and clarified in the contractors bid. No additional allowances will be made because of errors, ambiguities or omissions that should have been discovered during the preparation of the bid.

1.06 RESPONSIBILITY

- A. The work as specified in this division shall include; assuring that all required submittals conform to the intent and meaning of the documents, conditions at the Job Site, and all Local Codes and ordinances.
- B. Visit the Job Site to field check actual wall dimensions and utility rough-ins. Be responsible for furnishing, fabricating, and installing the equipment in accordance with the available space and utility services as they exist on the Job Site.
- C. Check all door openings, passageways, elevators, etc., to verify that the equipment can be transported to its proper location within the building. If necessary, check the possibility with the General Contractor of holding wall erection, placement of doorjambs, window, etc. for the purpose of moving equipment to its proper location.
- D. Notify the Architect and/or Consultant of any discrepancies between the plans and specification prior to fabrication of any equipment, to actual condition on the job.
- E. If any special hoisting equipment and operators are required, include cost as part of the bid for this work.

1.07 DELIVERY AND STORAGE

- A. All equipment specified herein shall be delivered to the Job Site; received and handled by the Contractor or his authorized agent. The Owner shall in no way be expected to store or handle any such equipment.
- B. All equipment shall be delivered in such a manner as to protect it against dirt, water, chemical or mechanical injury.
- C. Throughout the progress of the work, the Contractor shall keep the working area free of debris of all types resulting from his work.
- D. All packing material shall be removed from the project location by the Contractor.

1.08 COORDINATION

- A. Coordinate work with mechanical, electrical, plumbing, interiors and other trades whose work is in conjunction with equipment specified herein.

1.09 MEASUREMENTS

- A. Verify all dimensions shown on the drawings by taking field measurements at the Job Site prior to fabrication of equipment or ordering equipment. Proper fit and attachment of all parts is required and is the sole responsibility of the Food Service Contractor. If necessary, all equipment shall be fabricated so that it may be handled through finished door openings.

1.10 PRODUCT REQUIREMENTS

- A. Refer to Section 01 60 00.

1.11 GUARANTEE / WARRANTY

- A. All work shall be guaranteed by the Foodservice Equipment Contractor against all defects for a term of one (1) year from the date of notice of completion. This guarantee shall cover replacement of defective material at the Foodservice Equipment Contractor expense, including transportation and labor. This guarantee will not cover any cost for replacement of parts or work made necessary by carelessness or misuse of the equipment by others.
- B. The Food Service Equipment Contractor shall provide at his own expense the installation, start-up and service for one (1) year from the date of recording the notice of completion of the project; the replacement of all Condensing Units and other Refrigeration Devices supplied under this contract. In addition to this one (1) year free service, the Condensing Units shall have a five (5) year Compressor Warranty; said Warranty commencing at the date of completion.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal for construction purposes, where entirely concealed, shall be steel of wrought iron sections galvanized by the hot-drip process after fabrication. Bolts, screws, rivets, and similar attachments to this galvanized work shall be galvanized or brass. Exposed screw and rivet work shall be finished to match adjacent surfaces, flush and buffed smooth. Finished work shall be free of tool or construction marks, dents, or other imperfections; and at the completion of the work, all metal shall be gone over with a portable machine and buffed and dressed to perfect surfaces.
- B. All materials shall be new and of first grade. All gauges specified herein shall be minimum and shall be established after polishing. They shall refer to:
 - 1. U.S. Standard Gauge for sheets and plates.

2. Stainless steel shall be manufactured by one of the following: Allegheny Ludlum Steel Corporation, American Rolling Mills, U.S. Steel Corporation.
- C. The Contractor will be required to furnish a certified copy of the Mill Analysis of materials to the Architect and/or Consultant.
- D. Stainless steel sheets shall conform to ASTM A240, Type 304 Condition A, 18-8 having a No. 4 finish. No.2B finish shall be acceptable on surfaces of equipment not exposed to view. All sheets shall be uniform throughout in color, finish and appearance.
- E. Stainless steel tubing and pipe shall be Type 304, 18-8, having a No. 4 finish, and shall conform to either ASTM A213 if seamless or ASTM A249 if welded.
- F. Galvanized steel shall be approved grade of copper-bearing steel sheets with a minimum copper content of 20%. All sheets to be commercial quality, stretcher leveled, bonderized and re-rolled to insure smooth surface. Galvanized steel shall not be allowed in the construction and fabrication of any "Fabricated Assembly" items.
- G. All millwork materials shall be free from defect impairing strength, durability, or appearance; straight and free from warpage; and the best grade for their particular function. All wood shall be well seasoned and kiln dried and shall have an average moisture content of 8%, a maximum of 10%, and a minimum of 5%.
- H. Plywood and other woodwork of treatable species, where required by code, shall be fire-retardant treated to result in a flame spread rating of 25 or less with no evidence of significant progressive combustion when tested for 30 minutes duration under ASTM E-84 and shall bear the testing laboratory mark on the surface to be concealed.
- I. Concealed softwood or hardwood lumber shall be of Poplar, Douglas Fir, Basswood, Red Oak, Birch, Maple, Beech or other stable wood and shall be select or better grade, unselected for color and grain, surfaced four sides, square-edged, and straight. Basswood may be used where fire-retardant treated materials are required.
- J. Face veneers shall be matched for color and grain to produce balance and continuity of character. Mineral streaks and other discolorations, wormholes, ruptured grain, loose texture, doze or shake will not be permitted. Face veneer leaves on each surface shall be full-length, book matched, center matched, and sequence matched. Surfaces shall be sequenced, and Blueprint matched. Veneers not otherwise indicated shall be plain sliced. Backing veneers for concealed surfaces shall be of a species and thickness to balance the pull of the face veneers.
- K. Hardwood plywood for painted surfaces shall conform to U.S. Product Standard PS -51-71, Type I, and shall have sound Birch, Maple or other approved close grain hardwood faces suitable for paint finish.
- L. Plastic laminate surfaces shall be laminated with thermosetting decorative sheets in the color, pattern and style as selected by the Architect. Horizontal surfaces shall be laminated with sheets

conforming to Federal Specifications L-P-508F, Style D, Type I (general purpose), Grade HP, Class I, 1/16" thick, satin finish with rough sanded backs. Vertical surfaces shall be laminated with sheets conforming to Federal Specification L-P-598F, Style D, Type II (vertical surface), Grade HP, Class I, conforming, satin finish, 1/32" thick or heavier. Balance sheets for backs in concealed locations shall be .020" thick laminate backing sheets conforming to Federal Specification L-P-00508E, Style ND, Type V (backing sheet), Grade HP.

- M. Adhesive for application of plastic laminate to wood surfaces of counter tops shall be Phenetic, Resorcinol or Melamine adhesive conforming to Federal Specification MMM-A-181C and producing a waterproof bond. Adhesive for applying plastic laminate to vertical surfaces shall be either a waterproof type or a water-resistant type such as a Modified Urea Formaldehyde Resin liquid glue conforming to Federal Specification MMM-A-188C. Contact adhesive will not be acceptable.
- N. Plate glass shall be 1/2" thick safety glass with polished edges.
- O. Sealant shall be equal to that manufactured by General Electric. Silicone construction 1200 sealant; in either clear or approved color to match surrounding surfaces.
- P. Sound deadening material shall be equal to that manufactured by H.W. Mortell Co., Kankakee, Illinois, and shall be sprayed by use of a mechanical device to a thickness of not less than 1/8" thick.

2.02 FINISHES

- A. Paint and coatings shall be of an NSF approved type suitable for use in conjunction with Food Service Equipment. Such paint or coating shall be durable, non-toxic, non-dusting, non-flaking and mildew resistant, shall comply with all governing regulations and shall be applied in accordance with the recommendations of the manufacturer.
- B. All exterior, galvanized parts, exposed members of framework where specified to be painted shall be cleaned, properly primed with rust inhibiting primer, degreased, and finished with two (2) coats of epoxy-based grey Hammertone paint, unless otherwise specified.
- C. Stainless steel, where exposed, shall be polished to a #4 commercial finish. Where unexposed, finish shall be #2B. The grain of polishing shall run in the same direction wherever possible. Where surfaces are disturbed by the fabricating process, such surfaces shall be refinished to match adjacent undisturbed surfaces.

2.03 SHOP FABRICATED EQUIPMENT CONSTRUCTION

- A. Leg stands for open base tables or dish tables shall be constructed of 1-5/8" dia. 16-gauge stainless steel tubing, with stringer and cross braces of the same material. Joints between legs and cross braces shall be welded and ground smooth. Flattened ends on tube stretchers are not permitted. Mechanical fittings are also not permitted.

1. Stainless Steel Leg Sockets: Component Hardware Group, Inc. model A18-0206, or accepted equal; weld to underside of countertop framing or at bottom of enclosed cabinet unit and fastened with flush set screw locking device.
 2. Sanitary Type Stainless Adjustable Foot: Component Hardware Group, Inc. model A10-0851, or accepted equal
- B. Tabletops shall be 14-gauge stainless steel unless otherwise noted, with all shop seams and corners welded, ground smooth and polished. Tops of closed base fixtures shall be reinforced on the underside with a framework of 1-1/2" angles or 16-gauge stainless steel hat section; and on open pipe frames with a 4" channel at each pair of legs. The leg sockets shall be welded to this channel. The channel in turn stud welded to the top. Tops shall be reinforced so that there will be any noticeable deflection. Unless otherwise shown on the detail drawings, metal tops shall be turned down 2", and back at 15-degree angle, with 1-1/8" turn-under, except where adjacent to walls or other pieces of equipment. The wall side shall be turned up 10" and back 2" at a 45-degree angle. Ends of this splash are to be closed. Free corner of tops shall be spherical. All tops shall have 1/8" of sound-deadening material applied to the underside by use of spray equipment in an oven, smooth application for ease in cleaning.
- C. Enclosed bases or cabinet bodies shall be of the material and gauge hereinafter specified. They shall be enclosed on the ends and sides as required. The bases shall be reinforced at the top with a framework of 1-1/2" x 1-1/2" x 1/8" stainless steel angles fully welded to the base with the stainless-steel angles 36" on center (maximum), with all corners of said framework mitered and fully welded. All vertical joints of the bases shall be fully welded, ground and polished. All free corners of enclosed bases or cabinet bodies and all corners against walls and other fixtures shall be square. In the case of fixtures fitting against or between walls, the bodies shall be set in 1" from the wall line, but the tops shall be extended back to the wall line to permit adjustment to wall irregularities. A flush fitting vertical trim strip (extension of the vertical end mullion without vertical seam of the same material as the body shall be provided at each end of the body and shall extend 1" to the wall line). These fixtures shall be constructed to set on bases or legs as hereinafter specified and shall be set in mastic in a vermin-proof manner.
- D. Shelves, mullions and aprons shall be fabricated flush with the cabinet body, welded, ground, and polished. Butt joints are not acceptable.
- E. Drawers, to be furnished with stainless steel flush pull, Component Hardware Group Inc., model number P63-1012 or equal installed into the 18-gauge double-pan drawer front panel.
1. Stainless steel locks, Component Hardware Group, Inc., model number P30-4781 or equal for each drawer. All drawers are to be keyed alike.
 3. Stainless Steel full extension slides, Component Hardware Group, Inc., model no S52-0024 or equal. Provide two (2) per drawer. Slides to be installed so drawer will roll closed when released.
 4. Stainless steel removable drawer pan, Component Hardware Group, Inc., model number,

- S81-1520 or equal one (1) per drawer set loosely in a channel frame so it can be easily lifted out for cleaning. This supporting frame shall be welded stainless steel channel.
4. Drawer face panel to be constructed of 18-gauge stainless steel double pan construction. (Single metal thickness drawer faces are not be expectable.)
- F. Hinged doors in base cabinets shall be of double pan construction, insulated and constructed of 18-gauge stainless steel. Doors shall have wire type pull Component Hardware Group Inc., model number P46-1010 or equal installed as shown in elevations. Door pulls to be NSF and ADA compliant.
- G. Interior shelves shall be solid, non-removable 16-gauge stainless steel, with ends and backs provided with a 1-1/2" high turn-up against the body of the fixture and welded to the same. Front edge is to be turned down 1-1/2" and under 1/2", at the bottom shelf, beyond the edge of the base to prevent sagging and vermin collection.
- H. Under shelves on open tables shall be constructed of 16-gauge stainless steel, flanged down 90 degrees 1/2". The corners shall be welded to the legs. Under shelves shall be 10" from the floor. Backs shall be turned up 2".
- I. Elevated shelves shall be constructed of 16-gauge stainless steel with edges turned down in a square edge, and back 1/8"; except where shelves are adjacent to walls or other fixtures, where they shall be turned up 2". Corners shall be spherical, mounted on 14-gauge stainless steel support brackets.
- J. Sinks and drain boards shall be constructed of 14-gauge stainless steel. The working edge of the sink shall be provided with 5/8" radius sanitary rolled edge in one piece with rounded corners. The drain boards shall be made as an integral part of the sink; all vertical and horizontal corners shall be rounded with 5/8" radius; and the working front edges shall be maintained at one level, taking up the pitch of the drain boards by dropping the sink to allow for same. Depth of sink bowl shall be determined from the top bowl. Sinks shall be provided with back and end splashes with top edge flanged back 2-1/4" at 45-degree angle and attached to the building wall with "zee" clips. Splash back of sinks and drain boards shall be grained in the same direction. Suitable openings shall be cut for hot and cold-water supplies and waste outlets. All surface plumbing trim as called for on the drawings and herein specified shall be provided. Bottom of each sink bowl with center drain connection shall be fitted with a 2" lever type action waste valve mounted into the sink and made absolutely watertight. Sink bowls and drain boards shall have 1/8" of sound-deadening material underneath, spray-applied.
- K. Rivets, bolts and screws shall not be permitted in any exposed location.
- L. All welding shall be of the heliarc method with welding rod of the same composition as the parts welded. Welds shall be complete, strong, and ductile with excess metal ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of mechanical imperfections and shall be continuously welded so that the fixture shall appear as one-piece construction. Butt welds made by spot solder and finished by grinding are not acceptable.

- M. All exposed joints shall be ground flush with adjoining material and finished to harmonize therein. Whenever material has been sunk or depressed by welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surface and, if necessary, again ground to eliminate low spots. In all cases, the grain of rough grinding shall be removed by successive fine polishing operations.
- N. All exposed welded joints in stainless steel construction shall be suitably coated with an approved metallic-based paint.
- O. After galvanized steel members have been welded, all welds and areas where galvanizing has been damaged shall have a zinc dust coating applied.
- P. Seams shall be continuous welds flush and ground smooth.
 - 1. Field Joints: Flush welded, ground smooth and polished on the job, solder or rivets not allowed.
 - 2. Counter Tops: Field joints in stainless steel counter tops and drain boards butt welded with welds ground flush and smooth and polished to match original finish.
 - 5. Pass windows: Provide a complete all welded seamless counter from inside area to the outside ledge at each pass window location. Mechanical joints, butt joints or lap joints will not be accepted.

2.04 ELECTRICAL REQUIREMENTS

- A. Standard UL listed materials, devices and components shall be selected and installed in accordance with NEMA Standards and Recommendations and as required for safe and efficient use and operation of the Food Service Equipment without objectionable noise, vibration, and sanitation problems.
- B. Motors up to and including $\frac{1}{2}$ HP are to be wired for 120-volt, single phase. Fixtures totaling more than 1000 watts are to be wired for 208-volt, single-phase. Fixtures having multiple number of heating elements, can be wired for three-phase with the load balanced as equally as possible within the fixture.
- C. Heating elements having a connected load of up to and including 1000 watts are to be wired for 120-volt, single-phase. Fixtures totaling more than 1000 watts are to be wired for 208-volt, single-phase. Fixtures having multiple number of heating elements can be wired for three-phase with the load balanced as equally as possible within the fixture.
- D. Equipment where applicable shall be furnished with three-wire cord and plug.

2.05 PLUMBING TRIM, SINKS

- A. All vegetable and pot washing sinks, or other 14" deep sinks shall have Fisher Mfg. Co. Model 22209 series (2" drain size) quick opening drain. Fisher Mfg. Co. Model 60100 splash mounted faucet shall be mounted over each partition as shown on the drawings.
- B. All cook sinks, pantry sinks or other 10" or 12" deep sinks shall have Fisher Mfg. Co. Model 22209 series (2" drain size or as shown on the drawings) quick opening drain. Fisher Mfg. Co. Model 57649 faucets mounted as shown on the drawings.
- C. All Fisher Mfg., Co. faucets to be furnished as stainless steel to comply with AD1953 Standards and conform to NSF 61 Standard 9.
- D. Provide gas pressure regulators for installation by the Plumbing Contractor.
- E. FIRE SUPPRESSION GAS SHUT/OFF VALVE: Gas valve to be furnished by the Foodservice Equipment Contractor and furnished to the Plumbing Contractor for installation. Foodservice Equipment Contractor is to verify with Plumbing Division for gas line size. Valve to be located in an accessible location and if necessary, with access panel.

2.06 HARDWARE

- A. Elevated shelf brackets shall be as shown on the Drawings.
- B. Drawer and door handles shall be as shown on the Drawings.
- C. Hinges for all metal doors shall be Klein Hardware Co. 7870 series, finished in satin chrome.

2.07 REFRIGERATION

- A. Each refrigeration items specification is written to provide minimum specifications and scope of work. Refrigeration equipment shall be designed and installed to maintain the following general temperature unless otherwise specified.

a.	Walk-In Refrigerators	1.7°C / 35°F
b.	Walk-In Freezers	-23.2°C / -10°F
c.	Reach-In Refrigerators	1.7°C / 35°F
d.	Reach-In Freezers	-23.2°C / -10°F
e.	Undercounter Refrigerators	1.7°C / 35°F
f.	Undercounter Freezers	-23.2°C / -10°F
g.	Cold Pan	5°C / 41°F

PART 3 - INSTALLATION

3.01 POSITIONING OF EQUIPMENT

- A. Installation procedure, details and scheduling shall be so arranged that the work of other contractors may progress without unnecessary delay, interference or damage.
- B. The Contractor shall do all fitting, joining, fastening, scribing, caulking and adjusting necessary to install any fixed item of equipment in its designated location; and shall locate and/or store portable, non-fixed items as directed by the Architect and/or Consultant with due regard for the security and protection from damage of the items involved.

3.02 WORKMANSHIP

- A. Commencement of work shall constitute agreement with and acceptance of all conditions as found.
- B. Equipment shall be installed as shown on the plans. Where abutting, curved or irregularly shaped angles or projecting corners of walls occur, equipment shall be made to conform. Where several pieces of equipment are to be assembled in a group, the group shall be complete as whole, with all necessary filler or connecting pieces as may be required to make a complete, sanitary and vermin-proof group.
- C. Welded parts shall be non-porous and free of imperfections. Welds on galvanized metal shall be ground smooth, sandblasted and sprayed with molten zinc or 1200 degrees F to a thickness of .004". Tinning of welds will not be acceptable. Welds of stainless steel shall be ground and polished to the original finish and all grained in the same direction.
- D. All fixtures, unless made of stainless steel, shall be finished in sprayed lacquer in color as chosen by the architect; or if specifically stated, in "plastic laminate"; in pattern and/or color as selected by the Architect.

3.03 POST INSTALLATION PROCEDURES

- A. Prior to being offered for final acceptance, all equipment shall be thoroughly cleaned. This shall include removal of all stains, paint spots, protective wrapping and coatings, tapes, grease, oil, plaster, dust, polishing compounds, etc. and cleaning of floors in food service areas (broom clean) and signed off by the General Contractor with a copy to the Architect and/or Consultant.
- B. After installation at least ten (10) days prior to offering for acceptance, all equipment shall undergo a "Start-up" procedure by a Factory Authorized Service Dealer. Equipment is to be inspected, tested, calibrated and adjusted for normal operation conditions. If inspection or testing indicated defects, such defects shall be corrected, and the inspection and test repeated to insure a perfect operation of all equipment, prior to final acceptance and for a period ninety (90) days after final acceptance.
- C. Upon completion of the project, the Contractor shall furnish the Owner two (2) sets of Dimensional Prints, Data Sheets, Spare Parts Lists and Operating Manuals for each piece of mechanical equipment; each set shall be neatly bound in a loose-leaf binder, each set shall be complete with and Index of Equipment and with a complete List of Service Contracts with said

agencies to perform these services. In addition to this list: The Contractor shall submit for review of the Architect and/or Contractor and submittal to the Owner for his files, copies of Service Contracts with said agencies to perform these services. It shall be the responsibility of this Contractor to fill out and forward all warranty forms as required.

- D. This contractor shall arrange demonstrations of the operation and maintenance of all “Buy-Out” equipment by competent instructors. These demonstrations to take place within ten (10) days prior to the acceptance of the kitchen. All instruction periods shall be scheduled with the Architect and/or Consultant fourteen (14) days prior to commencement of same, and at times convenient to the Architect and/or consultant and Owner.

PART 4 - ITEMIZED EQUIPMENT SCHEDULE

4.01 FOOD SERVICE EQUIPMENT LIST AND DESCRIPTION

- A. Fabricated Equipment: Wherever the term “Fabricated Assembly” is used within the list noted below and description of Food Service Equipment, it shall be presumed to be followed by the phrase, “constructed to the configuration, dimension, detail and design as shown on the drawings and specifications and with workmanship and materials as specified above” and shall meet the Fabrication Detail Requirements of the latest edition of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA), and National Sanitation Foundation (NSF Standard 2).
- B. All Food Service Equipment shall be installed per the “Guidelines for Seismic Restraints of Kitchen Equipment” by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- C. All Food Service Equipment shall comply with the standards of The California Code of Regulations, Title 24, Part No. 2.
- D. All Food Service Equipment shall comply with the current California Energy Commission Appliance Efficiency Regulations.
- E. Equipment in the following schedule is listed by Item Numbers shown on Drawings.
- F. Equipment listed is schedule as (OFCl) means Owner Furnished Contractor Installed.

1. SCHEDULED ITEMS

ITEM #1 AIR CURTAIN

Quantity: One (1)

Manufacturer: Berner (or equal)

Model: SLC07-1036A

Status: CFCI

Sanitation Series Low Profile Air Curtain, 36"L, unheated, (1) 1/5 hp motor, for doors up to 7' high, specify exterior, interior or exterior mounting, UL, cULus, UL EPH, MADE IN USA

Accessories:

- 1 ea. Five year parts warranty (unheated units)
- 1 ea. If special freight fees are requested, (See below) all applicable fees will be added to the invoice; fees subject to change; contact factory for addition information.
- 1 ea. Model A 120v/60/1-ph
- 1 ea. White powder coat exterior finish, standard
- 1 ea. Model 9503SD025-PR-A Plunger/Roller Door Switch, NEMA 1, max. amp draw of 20 amps, 120-240v/1ph
- 1 ea. Contractor to provide anchorage per DSA approved drawings.

ITEM #2 MOBILE HEATED CABINET

Quantity: Two (2)

Manufacturer: FWE / Food Warming Equipment Co., Inc. (or equal)

Model: UHST-13

Status: CFCI

Heated Cabinet, mobile, slim-line, (13) pair universal tray slides, (13) 18" x 26" or (26) 12" x 20" pan capacity, 4-1/2" OC, adjustable to 1-1/2" increments, top mounted forced air heating system, adjustable thermostat, -90°F to 190°F temperature range, insulated, (1) flush mounted door, push bars, wraparound bumper, stainless steel construction, 5" casters (2) rigid & (2) swivel with brakes, UL, cULus, UL EPH Classified, IPX4, ENERGY STAR®

Accessories:

- 2 ea. Two year limited parts & one year labor warranty, standard
- 2 ea. 120v/50/60/1-ph, 14.1 amps, 1692 watts, cord with NEMA 5-15P, standard (US)
- 2 ea. Electronic Control
- 2 ea. Standard door(s)
- 2 ea. The contractor is to provide anchorage per DSA-approved documents.

ITEM #3 HAND SINK

Quantity: One (1)

Manufacturer: Advance Tabco (or equal)

Model: 7-PS-68

Status: CFCI

Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, with heavy duty splash mounted gooseneck faucet with wrist blades, basket drain, wall bracket, NSF, cCSAus

Accessories:

- 1 ea. Model 7-PS-14 P-trap, 1-1/2", 22 gauge
- 1 ea. Model 7-PS-34 Soap & Towel Dispenser, for 17" wide hand sinks

ITEM #4 HAND SINK

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

Model: HSAP-14-ADA-FW

Status: CFCI

Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF

Accessories:

- 1 ea. Model 313305 T&S Extra Heavy Duty Gooseneck Faucet, wrist handles, splash mount 4" OC, NSF
- 1 ea. Model 318495 Drinking Bubbler, NSF
- 1 ea. Model -LRS Left & right side splashes

ITEM #5 PREP SINK

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

Model: FN2018-1-24L-14/3

Status: CFCI

Spec-Master® FN Series Sink, one compartment, 45-1/2"W x 27"D, 14/304 stainless steel top, coved corners, 18" wide x 20" front-to-back x 14" deep compartment, 24" drainboard on left, 9-1/2"H backsplash with 1" upturn & tile edge, 8" OC splash mount faucet holes, rolled edges on front & sides, includes 3-1/2" basket drain, stainless steel crossbracing on all sides, stainless steel legs & adjustable bullet feet, NSF

Accessories:

- 1 ea. Model E101A Turn down back of splash per table with Z clip
- 1 ea. Model 300716 Faucet, 12" long, splash-mounted mixing faucet, 8" centers, swing nozzle, NSF
- 1 ea. Model -TB Twist bracket, per drain

ITEM #6 COMBI OVEN, ELECTRIC

Quantity: Two (2)

Manufacturer: RATIONAL (or equal)

Model: ICP 6-FULL E 208/240V 3 PH (LM100CE)

Status: CFCI

Combi Oven, electric, (6) 18" x 26" sheet pan or (12) 12" x 20" steam pan or (6) 2/1 GN pan capacity, (3) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 208/240v/60/3-ph, 22.4 kW, CE, IPX5, UL, cULus, NSF, ENERGY STAR-®

Accessories:

- 2 ea. 2 years parts and labor, 5 years steam generator warranty

- 2 ea. Model EXTWARRANTY K-12 Extended Warranty: Extends the warranty for 12 months beyond the Original Equipment Warranty to 3 years parts and labor. (NET)
- 2 ea. Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 2 ea. Model 9999.2002 Pre-Installation Site Consultation, provides an installation consultation to ensure the site has proper space and connections for gas, electric, drain & water, one (1) Consultation is needed for every four (4) cooking systems, includes 100 miles (200 miles round trip). (see attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 2 ea. Model 9999.1009 Extended Travel Zones, for extra distance beyond the 100 miles(200 round-trip) that is included. THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 2 ea. Model 9999.2201 RCI RATIONAL Certified Installation, new certified installation for each individual electric table-top iCombi on a stand or counter, 100 miles (200 round-trip) included. (Do not use for Combi-Duo, See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 2 ea. Model 9999.1009 Extended Travel Zones, for extra distance beyond the 100 miles(200 round-trip) that is included. THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 2 ea. Model 1900.1158US Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
- 2 ea. Note: The RATIONAL Water Filtration Systems helps provide consistent high-quality water to your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines, and chlorine while delivering the required flow rates.
- 2 ea. Model 60.31.165 Stand II MobilityLine, 31-1/8"H, (14) pairs of support rails, top and side panels, (4) 7-3/4" casters, for iCombi 6- and 10-full size Classic/Pro
- 2 ea. Model 60.76.178 UltraVent® Plus Ventless Recirculating Condensation Hood, with HEPA filter for smoke capture, filters smoke, for single or Combi-Duo, for 6- and 10-full size (electric), 120v/50/60/1-ph, 170 watts, 6' cord, NEMA 5-15P
- 2 ea. Model 9999.2240 RCI RATIONAL Certified Installation, for UltraVent or UltraVent Plus at the time of Certified Unit Installation, (See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE. USA ONLY (NET)
- 2 ea. Contractor to provide anchorage per DSA approved drawings.

ITEM #6.1 STAINLESS STEEL WALL LINING

Quantity: One (1)

Manufacturer: American Stainless-Steel Corp. (or equal)

Model: FABRICATED ITEM

Status: CFCI

Refer to drawings for size and configurations.

- A. 18-gauge stainless steel wall panels (minimum length to be 36") Wall lining to be applied with Dow Corning #995 adhesive. " Liquid Nails" is not acceptable.

- B. Wall panels shall be installed horizontally and fluted vertically every 6" from top of floor base to bottom lip of hood
- C. Wall lining shall be installed without exposed screws and bolts.
- D. Provide stainless steel "tees" and/or "ells" at each panel on both sides, bottom and top.

ITEM #7 MOBILE TABLE

Quantity: Three (3)

Manufacturer: American Stainless-Steel Corp. (or equal)

Model: FABRICATED ITEM

Status: CFCI

Fabricated assembly in length and configuration as shown on the drawings and shall include the following:

- A. Work area top to be 14-gauge stainless steel with 2" turn down on all four sides.
- B. Provide and install 16-gauge stainless steel tubular legs, stainless steel welded leg sockets, and fully welded stainless-steel cross rail bracing. Provide 16-gauge stainless steel undershelf as shown.
- C. Provide swivel expanding stem casters Component Hardware Group, Inc. (4) ea. Model CMS4- 4GBN brake model.
- D. Provide (1) ea. utensil drawer Component Hardware Group, Inc. Model S90-0020N drawer mounted to the underside of mobile worktable Item No. 7. Provide all necessary hardware mounting angles etc. for a complete installation. Slides to be installed so drawer will roll closed when released.

ITEM #8 SERVING COUNTER

Quantity: One (1)

Manufacturer: American Stainless-Steel Corp. (or equal)

Model: FABRICATED ITEM

Status: CFCI

Fabricated assembly in length and configuration as shown on the drawings and shall include the following:

- A. Base section to be 16-gauge stainless steel formed metal construction complete with 16-gauge stainless steel bottom and mid shelves. Work top to be 14-gauge stainless steel with a 14-gauge stainless steel backsplash 1" thick to wall, turn down ½" to "Z-clips" at where counter meets wall.
- B. Top to be constructed with square edge 2" turn down at edge with 1" return on all sides.
- C. Top to be continuous through window with no joints or seams and verify edge is free of sharp edges or burrs.
- D. Provide adjustable seismic flanged feet. Refer to drawings for configuration and quantity.
- E. Provide 16-gauge stainless steel undershelf as shown.
- F. Contractor to verify clearances for roll down door tracks at splash and sneeze guard where applicable.

- G. Provide adjustable seismic flanged feet. Refer to drawings for configuration and quantity.

ITEM #9 SNEEZE GUARD, STATIONARY

Quantity: One (1)

Manufacturer: Premier Metal & Glass (or equal)

Model: FM2N-A

Status: CFCI

Adjustable Dual-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, adjustable end panels, front mount, 1" OD round stainless support posts, NSF & cULus listed (Contact Premier Sales Department for Pricing)

Accessories:

- 1 ea. Contractor to verify length with drawings and onsite conditions
- 1 ea. 1" OD Stainless Steel tubing (Contact Premier Sales Department for details)
- 1 ea. NOTE: Certain finishes/tubing combos not recommended, Contact Premier Sales Department for samples and details
- 1 ea. Contact Premier Sales Department for spans exceeding the maximum allowed
- 1 ea. Both end panels reversible.

ITEM #10 HOT FOOD WELL UNIT, DROP-IN, ELECTRIC

Quantity: One (1)

Manufacturer: Duke Manufacturing (or equal)

Model: WWG4

Status: CFCI

Waterless Hot Food Well Drop-In Unit, ganged, electric, dry operation, with (4) 12" x 20" hot food well, 60-1/4"W x 24-1/4"D x 12-3/4"H, stainless steel well, removable FDA approved silicone rubber liner, fully insulated galvanized exterior housing, touch screen control panel, **without drain**, 6' cord & plug, UL, cULus

Accessories:

- 1 ea. Model WWG-4-208 208v/60/1-ph, 9.6 amps, NEMA 6-20

ITEM #10.1 SNEEZE GUARD, STATIONARY

Quantity: One (1)

Manufacturer: Premier Metal & Glass (or equal)

Model: FM2N-A

Status: CFCI

Adjustable Dual-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, adjustable end panels, front mount, 1" OD round stainless support posts, NSF & cULus listed (Contact Premier Sales Department for Pricing)

Accessories:

- 1 ea. Contractor to verify length with drawings and onsite conditions
- 1 ea. 1" OD Stainless Steel tubing (Contact Premier Sales Department for details)

- 1 ea. NOTE: Certain finishes/tubing combos not recommended, Contact Premier Sales Department for samples and details
- 1 ea. Contact the Premier Sales Department for spans exceeding the maximum allowed
- 1 ea. Both end panels reversible.

ITEM #11 MOP DRIP TRAY

Quantity: One (1)
Manufacturer: Advance Tabco (or equal)
Model: K-243
Status: CFCI
Mop Drainage Tray, stainless steel

ITEM #11.1 MOP HOLDER

Quantity: One (1)
Manufacturer: Advance Tabco (or equal)
Model: K-242
Status: CFCI
Mop Hanger, 23", accommodates (3)

ITEM #12 MOP HOLDER

Quantity: One (1)
Manufacturer: Advance Tabco (or equal)
Model: WCH-15-36
Status: CFCI
Cabinet, wall mount, enclosed design with (2) hinged doors, 36"W x 15"D, with single intermediate shelf, 18/430 stainless steel construction, NSF

ITEM #13 SHELVING UNIT, PLASTIC WITH POLY EXTERIOR STEEL POSTS

Quantity: Five (5)
Manufacturer: Cambro (or equal)
Model: CPMU244867V4480
Status: CFCI
Premium Mobile Starter Unit, 24"W x 48"L x 67"H, 4-tier, withstands temperature -36°F (-38°C) to 190°F (88°C), includes: (4) vented polypropylene shelf plates with Camguard® antimicrobial protection, (2) pre-assembled post kits (posts constructed of steel with polypropylene exterior), (8) traverses, molded-in dovetails, (2) sets of post connectors, (4) premium swivel casters with total locking brake, 900 lbs. max capacity, speckled gray, NSF. Contractor to provide anchorage per the DAS approved drawings.

ITEM #C-1 REACH-IN REFRIG/ FREEZER

Quantity: Five (5)
Status: Existing to be Reused
The contractor is to verify utility requirements with onsite conditions.

ITEM #C-2 THREE COMPARTMENT SINK

Quantity: One (1)

Status: Existing to be Reused

The contractor is to verify utility requirements with onsite conditions.

ITEM #C-3 MILK COOLER

Quantity: One (1)

Status: Existing to be Reused

The contractor is to verify utility requirements with onsite conditions.

ITEM #C-4 MILK COOLER

Quantity: One (1)

Status: Existing to be Reused

The contractor is to verify utility requirements with onsite conditions.

ITEM #C-5 DUNNAGE RACK

Quantity: One (1)

Status: Existing to be Reused

The contractor is to verify utility requirements with onsite conditions.

END OF SECTION

SECTION 11 68 16
PLAY STRUCTURES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The conditions of the Contract and requirements of Division 1, General Requirements, are part of this Section and apply to work of this Section as fully as if herein repeated.
- B. The work includes, but is not necessarily limited to, the following:
 - 1. Installation of playground equipment.
 - 2. Other items as may be specified or shown on the Drawings.
- C. Furnish and install any incidental work not shown or specified but which can reasonably be inferred as required and necessary to provide complete and workable systems.

1.02 RELATED SECTIONS

- A. Section 31 23 00: Trenching, Backfilling & Compaction.
- B. Section 32 13 00: Portland Cement Concrete Paving.
- C. Section 32 18 16.13: Playground Protective Surfaces.

1.03 SUBMITTALS

- A. Refer to Section 01300.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer or applicator who has a minimum 5 years of experience in installing play equipment types similar to that required for this Project and who is acceptable to manufacturer of primary materials.
- B. Single Source Responsibility: Obtain urethane cement composition flooring materials, including primers, resins, hardening agents, and finish, or sealing coats, from a single manufacturer.
- C. Qualified Materials: Request for material approvals for any products other than the specified products must be submitted to the architect two weeks prior to the bid, including complete application specification, physical characteristics, and chemical resistance data. Any request after this date will not be accepted. Failure of performance requires immediate removal and replacement of unapproved substituted material with those originally specified at no cost to the Owner, Architect, Construction Manager, or General Contractor.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

- A. Work and materials shall be in full accord with Title 24, California Code of Regulations; California Plumbing Code; California Building Code; California Electric Code; State Fire Marshall; California OSHA; National Fire Protection Association; and other applicable state or local laws or regulations. Nothing in drawings or specifications shall be construed to permit work not conforming to these Codes.
- B. Installation shall comply with 11B-1008.4.

1.06 FEES, PERMITS, AND UTILITY SERVICES

- A. Obtain and pay for permits and service charges required in installation of Work. Arrange for required inspections and secure approvals for authorities having jurisdiction.

1.07 WARRANTY

- A. 100-YEAR LIMITED WARRANTY - On all PlayBooster, PlayShaper and PlaySense aluminum posts, stainless steel fasteners, clamps, beams, and caps, against structural failure due to corrosion/natural deterioration or manufacturing defects, and on PlayBooster, Evos and Weevos steel posts and arches against structural failure due to material or manufacturing defects.
- B. 15-YEAR LIMITED WARRANTY - On all plastic components (including TuffTimbers edging), all steel components (except 100-year steel posts), Mobius climbers, decks and TenderTuff coatings (except Wiggle Ladders, Chain Ladders and Swing Chain) against structural failure due to material or manufacturing defects. TuffTurf tiles against material or manufacturing defects.
- C. 10-YEAR LIMITED WARRANTY - On concrete products against structural failure due to natural deterioration or manufacturing defects. Does not cover minor chips, hairline cracks or efflorescence.
- D. 8-YEAR LIMITED WARRANTY - On Aeronet climbers and climbing cables against defects in materials or manufacturing defects. On CoolToppers fabric against failure from significant fading, deterioration, breakdown, mildew, outdoor heat, cold or discoloration. This warranty is limited to the design loads as stated in the specifications found in the technical information.
- E. 3-YEAR LIMITED WARRANTY - On all other parts, i.e.: CableCore products, swing seats and hangers, grills, Mobius climber handholds, Wiggle Ladders, Chain Ladders and Swing Chain, Track Ride trolleys and bumpers, all rocking equipment including Sway Fun gliders, PVC belting material, HealthBeat hydraulic cylinders, Seesaws, Wiggle Ring Bridge, etc., against failure due to corrosion/natural deterioration or manufacturing defects.
- F. This warranty does not include any cosmetic issues or wear and tear from normal use. It is valid only if the play structures and/or equipment are erected to conform with Landscape Structures' installation instructions and maintained according to the maintenance procedures furnished by Landscape Structures Inc. For a full text of the warranty, contact your playground consultant.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Landscape Structures (basis of design).
- B. Miracle Playground Sales.
- C. Approved Equal.

2.02 MATERIALS – GENERAL

- A. Provide each item listed herein or shown on drawings of quality noted or approved equal. All material shall be new, full weight, standard in all respects and in first-class condition. As far as possible, all materials used shall be of same brand or manufacture throughout for each class of material or equipment. Materials shall be of domestic manufacture and shall be tested within Continental United States.
- B. All the materials used in the manufacturing of PlayBooster and PlayShaper play structures have a proven track record of durability and are widely used in the playground industry. All play structures have been certified and validated to be in conformance with the ASTM F1487 Standard. Play structures displaying the CSA and TUV logos are certified to those standards. To the best of our knowledge, they also conform to the U.S. Consumer Products Safety Commission (CPSC) Guidelines. Unless otherwise noted, all play structures are considered accessible according to the 2010 ADA Standard for Accessible Design.
- C. Material: All materials shall be structurally sound and suitable for safe play. Durability shall be ensured on all steel parts by the use of time-tested coatings such as zinc plating, galvanizing, ProShield finish, TenderTuff coating, etc. Colors shall be specified.
- D. Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless-steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications). All primary fasteners shall include a locking patch type material that will meet the minimum torque requirements of IFI-125. Manufacturer to provide special tools for pinned tamperproof fasteners.
- E. TenderTuff Coating: Metal components to be TenderTuff-coated shall be thoroughly cleaned in a hot phosphatizing wash system, then primed with a water-based thermosetting solution. Primed parts shall be preheated prior to dipping in UV stabilized, liquid polyvinyl chloride (PVC), then salt cured at approximately 400 degrees. The finished coating shall be approximately .080" thick at an 85 durometer with a minimum tensile strength of 1700 psi and a minimum tear strength of 250 lbs./inch. Standard colors are available, all with a matte finish.
- F. ProShield Finish: All metal components with ProShield finish shall be thoroughly cleaned and pretreated through a multi-stage wash system. Parts are then thoroughly dried, preheated and processed through a set of automatic powder spray guns where a minimum .002" of epoxy

primer is applied. A minimum .004" of architectural-grade Super Durable polyester TGIC powder is applied. The average ProShield film thickness is .006".

1. ProShield is formulated and tested per the following ASTM standards. Each color must meet or exceed the ratings listed below:
2. Hardness (D3363) rating 2H.
3. Flexibility (D522) pass 1/8" mandrel.
4. Impact (D2794) rating minimum 80 inch-pounds.
5. Salt Fog Resistance (B117 and D1654) 4,000 hours and rating 6 or greater.
6. UV Exposure (G154, 340 bulb) 3,000 hours, rating delta E of 2, and 90 percent gloss retention*.
7. Adhesion (D3359, Method B) rating 5B.

The Paint Line shall employ a "checkered" adhesion test daily. Standard colors are available.

* Certain colors may exceed delta E of 2. Contact Landscape Structures for exceptions.

- G. JDecks: All decks shall be of modular design and have 5/16" diameter holes on the standing surface. There shall be a minimum of (4) slots in each face to accommodate face mounting of components. Decks shall be manufactured from a single piece of low carbon 12 GA (.105") sheet steel conforming to ASTM specification A-1011. The sheet shall be perforated with a return flange on the perimeter to provide the reinforcement necessary to ensure structural integrity. There shall be no unsupported area larger than 3.5 square feet. The unit shall then be TenderTuff-coated brown or gray only. Decks shall be designed so that all sides are flush with the outside edge of the supporting posts.
- H. Concrete Products: Two processes are used to produce concrete products. (See specific product installation/specification documents.)
1. Glass Fiber Reinforced Concrete (GFRC) Products: Glass fiber is alkali-resistant (AR) with high tensile properties formulated for concrete. GFRC nominal product thickness is 1" with a unit weight of about 12 lbs. per square foot and an average ultimate flexural strength of 2,100 psi per ASTM C947. Finish: Exterior latex paint suited for concrete applications.
 2. Precast Concrete Products: Wet-cast solid, molded concrete with an average compressive strength of 5,000 psi per ASTM C39. Unit weight range of about 115-145 lbs per cubic foot. Finish: Exterior latex paint suited for concrete applications.
- I. Rotationally Molded Polyethylene Parts: These parts shall be molded using prime natural linear low-density polyethylene having a tensile strength of 2400 psi per ASTM D638. Rotational

molding resin is compounded with color and UV-stabilizing additives with a nominal wall thickness typically 1/4" with some variation depending upon product type. Standard colors are available.

- J. Recycled Permalene Parts: These parts shall be manufactured from 3/4" high-density polyethylene that has been specially formulated for optimum UV stability and color retention. Products shall meet or exceed density of .960 G/cc per ASTM D1505, tensile strength of 2400 PSI per ASTM D638. Available in a three-layer product with (2) .100" thick colored exterior layers over a .550" thick recycled Black interior core. Standard colors are available.
- K. Footings: Unless otherwise specified, the bury on all footings shall be 34" below Finished Grade (FG) on all in-ground play events/posts. Other types of anchoring are available upon request.
- L. Hardware Packages: All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with the part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to the job number, assembler's name, date, and time the package was assembled, work center number and work order number.
- M. Installation Documentation: All shipments shall include a notebook or packet of order-specific, step-by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, area required information and detailed material specifications.
- N. Packing List: All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.
- O. Packaging: All components shall be individually wrapped, or bulk wrapped and placed on skids (pallets) then shrink-wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. Other components shall be individually wrapped, or bulk wrapped to provide protection during shipment.
- P. Maintenance Kit: An order-specific maintenance kit shall be provided for each structure order. The kit will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new condition. The kit also includes touch-up primer, appropriate color touch-up paint, sandpaper, appropriate color touch-up PVC and additional installation tools for the tamperproof fasteners.

2.03 PlayBooster General Specifications (**ages 5-12**).

- A. Main Components:
 - 1. Vertical Ascent 56" DK
 - 2. Casade Climber 64" DK DM

3. Square Tenderdeck
 4. Triangular Tenderdeck
 5. Kick Plate 8" Rise
 6. Curved Transfer Module Left 48" DK DM
 7. Panels – Permalene
 8. Chimes Reach Panel Ground Level
 9. Double Swoosh Slide
 10. Firepole Perm Handholds 64" DK DB
 11. WhooshWinder Slide 72" Dk DB
- B. Posts: Post length shall vary depending upon the intended use and shall be a minimum of 42" above the deck height. All posts shall be ProShield finished to specified color. All posts shall have a "finished grade marker" positioned on the post identifying the 34" bury line required for correct installation and the top of the loose fill protective surfacing. Top caps for posts shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self-sealing rivets. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the post to increase the footing area.
- C. Steel Posts: All steel PlayBooster posts are manufactured from 5" O.D. tubing with a wall thickness of .120" and shall be galvanized after rolling and shall have both the I.D. and the cut ends sprayed with a corrosion resistant coating. Steel Post Mechanical Properties:
1. Yield Strength (min): 50,000 PSI.
 2. Tensile Strength (min): 55,000 PSI.
 3. Elongation: 25% in 2 inches.
 4. Modulus of Elasticity: 29.5 x 10⁶ PSI
- D. Aluminum Posts: All aluminum PlayBooster posts are manufactured from 6005-T5 extruded tubing conforming to ASTM B-221. Posts shall have a 5" outside diameter with a .125" wall thickness. Aluminum Post Mechanical Properties:
1. Yield Strength (min): 35,000 PSI.
 2. Tensile Strength (min): 38,000 PSI.

3. Elongation: 10% in 2 inches.
 4. Modulus of Elasticity: 10 x 10⁶ PSI
- E. Arch Posts: Aluminum arch posts shall be manufactured from 6005-T5 alloy. The arch shall be formed to a 21" center line radius to complement the 42" center-to-center module. The arch shall be of one continuous piece construction. There shall be no welds or additional pieces mechanically fastened to manufacture the arch. Each arch shall be designed to provide a minimum of 90 1/2" clear span from the deck to the inside of the arch at the radius peak. Arches shall be ProShield finished to a specified color.
- F. Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be die cast using a 369.1 aluminum alloy and have the following mechanical properties:
1. Ultimate Tensile: 47,000 PSI.
 2. Yield Strength: 28,000 PSI.
 3. Elongation: 7% in 2 inches.
 4. Shear Strength: 29,000 PSI.
 5. Endurance Limit: 20,000 PSI.
 6. Each functional clamp assembly shall have an appropriate number of half clamps and shall be fastened to mating parts with (2) 3/8" x 1 1/8" pinned button head cap screws (SST) and (2) stainless-steel (SST) recessed "T" nuts. A 1/4" aluminum drive rivet with stainless steel pin is used to ensure a secure fit to the post.
- G. PlayBooster clamps have three functional applications and shall be named as follows:
1. Offset hanger clamp assembly
 2. Deck hanger clamp assembly
 3. Hanger clamp assembly
- H. Netplex Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be die cast using a 369.1 aluminum alloy and have the following mechanical properties:
1. Ultimate Tensile: 47,000 PSI.
 2. Yield Strength: 28,000 PSI.
 3. Elongation: 7% in 2 inches.
 4. Shear Strength: 29,000 PSI.

5. Endurance Limit: 20,000 PSI.
 6. Each functional clamp assembly shall have an appropriate number of rope clamps and back clamps and shall be fastened to each other with (2) 5/8" x 1 1/2" pinned button head cap screws (SST) and (2) stainless-steel (SST) recessed "T" nuts. Either a face clamp shall be fastened to rope clamp with (2) 3/8" by 1-3/8" pinned button head cap screws or a single tab casting plate shall be fastened to rope clamp with (4) 3/8" by 1-3/8" pinned button head cap screws with 3/8" SAE flat washers. A 1/4" x 5/8" aluminum drive rivet with stainless steel pin is used to ensure a secure fit to the post.
- I. Geoplex Clamps: All clamps are ProShield finished and, unless otherwise noted, shall be fabricated from:
1. 7GA using .179" (4,54 mm) T316 stainless steel.
 2. Ultimate Tensile: 84,000 PSI.
 3. Yield Strength: 25,000 PSI.
 4. Each functional clamp assembly shall have an appropriate number of locking clamps and shall be fastened to mating parts with (2) 3/8" x 7/8" pinned button head cap screws (SST) with (2) 3/8" SAE flat washers. A 1/4" aluminum drive rivet with stainless steel pin is used to ensure a secure fit to the post.
- J. Steel-reinforced cables: Made of tightly woven, polyester-wrapped, six-stranded galvanized steel cable. These abrasion-resistant, color-stable cables are extremely durable and vandal resistant. Available in Black or Red. Some products available in Black only or Red only.
- K. PlayOdyssey Structural Frame: Post length of the double ladder/central column shall vary depending upon the deck height and shall be flush with the bottom of a deck infill or a minimum of 46" above the deck height. All posts shall be ProShield finished to specified color. All posts shall have a "finished grade marker" positioned on the post identifying the 60" bury line required for correct installation and the top of the loose fill protective surfacing. Post caps shall be aluminum die cast from 369.1 alloy and ProShield finished to match the post color. All caps shall be factory installed and secured in place with (3) self-sealing rivets. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the ladder posts to increase the footing area. Ladders are bolted together below grade to act as a single column for installation purposes. The deck support weldments/arms are comprised of 5/16" (.313") steel conforming to 1010 steel per ASTM A635 and welded to a 52" steel post. Arms are secured to each ladder post with (4) 5/8" x 1 1/2" pinned button head cap screws through (2) 1/4" flanges.
- L. PlayOdyssey Optional Aluminum Roof Posts: All formed aluminum PlayOdyssey roof posts are manufactured from 6005-T5 extruded tubing conforming to ASTM B-221. Posts shall have a 5" outside diameter with a .125" wall thickness. Post sleeve shall have 4.675" outside diameter with a .150" wall thickness. Post cap shall be aluminum die cast from 369.1 alloy and ProShield

finished to match the post color. All caps shall be factory installed and secured in place with (3) self-sealing rivets.

- M. Vibe Handholds: Rotomolded shell, with 7 GA (.179") HRPO steel sheet insert that is zinc plated then ProShield finished. Standard colors are available.
- N. Vibe Roof: Rotomolded shell, with 12 GA (.105") HRPO steel sheet insert that is zinc plated then ProShield finished. Standard colors are available.
- O. Vibe Enclosures: Rotomolded shell, with 7 GA (.179") HRPO steel sheet insert that is zinc plated then ProShield finished. Standard colors are available. Option of 10 activity panels available in standard Permalene® colors. Also available bubble or window panel made of 1/4" clear polycarbonate.

2.04 Smart Play General Specifications (**ages 2-5**)

- A. Main Components:
 - 1. Motion with Play Table DB
 - 2. Exit Footer. Finish: Proshield
 - 3. Tunnel Section
 - 4. Bongo
 - 5. Panels – Permalene
 - 6. Marble
 - 7. Race Track
 - 8. Bell and Striker
 - 9. Slide
- B. Fasteners: Primary fasteners shall be socketed and pinned tamperproof in design, stainless steel (SST) per ASTM F 879 unless otherwise indicated (see specific product installation/specifications).
- C. Belt:.315" (8,00 mm) Thick mini rough top rubber belting with polyester fabric plys, black in color.
- D. Mid-Support: Weldment comprised of 1.315" (33,40 mm) O.D. RS-20 (.080" - .090") (2,03 mm-2,28 mm) galvanized steel tubing and 1/4" (6,35 mm) mounting plate. Finish: ProShield, color specified.

- E. Attachment Block: U.V. stabilized high-density polyethylene, tan in color.
- F. Chain: Steel 3/16" (4,75 mm) straight link chain, 800 lb. (362,87 kilograms) working load limit. Finish: TenderTuff, color specified.
- G. Post: Weldment comprised of 2.375" (60,33 mm) O.D. RS20 (.095"-.105") (2,41 mm - 2,67 mm) wall galvanized steel tubing, 1/4" (6,35 mm) HRPO steel sheet and 7 GA. (.179") (4,55 mm) HRPO steel sheet. Finish: ProShield, color specified.
- H. GripX Deck Surface: 3/4" (19,05 mm) Thick Permalene®, black in color.
- I. Deck Frame: Fabricated from 1/4" (6,35 mm) HRPO steel sheet. Finish: ProShield, color specified.
- J. Roof: Fabricated from 7 GA. (.179") (4,55 mm) HRPO steel sheet. Finish: ProShield, color specified.
- K. Tunnel Support: Weldment comprised of 2.375" (60,33 mm) O.D. RS20 (.095"-.105") (2,41 mm - 2,67 mm) wall galvanized steel tubing, and 1/8" (.125") (3,18 mm) HRPO steel sheet. Finish: ProShield, color specified.
- L. Chain Ladder Footer: Weldment comprised of 1.900" (48,26 mm) O.D. RS20 (.090"-.100") (2,29 mm - 2,54 mm) wall galvanized steel tubing and 1/4" (6,35 mm) HRPO steel sheet. Finish: ProShield, color specified.
- M. Belt Climber Frame: Weldment comprised of 1.315" (33,40 mm) O.D. RS20 (.080" - .090") (2,03 mm-2,29 mm) galvanized steel tubing, 1/4" (6,35 mm) HRPO steel sheet and 1/8" (.125") (3,18 mm) HRPO steel sheet. Finish: ProShield, color specified.
- N. Puzzle Handrail: Weldment comprised of 1.315" (33,40 mm) O.D. RS20 (.080" - .090") (2,03 mm-2,29 mm) galvanized steel tubing, and 1/4" (6,35 mm) HRPO steel sheet. Finish: ProShield, color specified.
- O. Race Track Tab: Fabricated from 7 GA. (.179") (4,55 mm) HRPO steel sheet. Finish: ProShield, color specified.
- P. Race Track Frame: Fabricated from 1/8" (.125") (3,18 mm) HRPO steel sheet. Finish: ProShield, color specified.
- Q. End Panel Supt.: Weldment comprised of 1/4" (6,35 mm) HRPO steel sheet and 3/8" (9,53 mm) re-bar. Finish: ProShield, color specified.
- R. Bell Striker: Recycled Permalene, color specified.
- S. Bell: Fabricated from 10 GA. (.135") (3,42 mm) HRPO low carbon steel. Finish: ProShield, color specified.

- T. Slide: Rotationally molded from U.V. stabilized linear low-density polyethylene, color specified.

2.05 PlayShaper General Specifications (ages 2-5)

- A. Posts: 2 3/8" square aluminum posts shall have a minimum wall thickness of .125" and be extruded of 6005-T5 aluminum alloy and have rounded corners and ribbed faces for maximum safety. A cast aluminum top cap shall be installed at the factory with stainless steel knurled spacers and aluminum drive rivets. Flanges for panels and deck supports shall be extruded of 6061-T6 aluminum alloy and slide into slots extruded in posts. Flanges and deck supports shall be attached in the factory with stainless steel knurled spacers and aluminum drive rivets. All direct bury posts shall have a "finished grade marker" positioned on the post identifying the 34" bury line and the top of the required surfacing. A molded low-density polyethylene cap, with drain holes, shall be pressed onto the bottom end of the post to increase the footing area. Posts shall have a post number sticker for installation purposes. All surface mount posts shall be continuously welded to a 1/4" x 6" square 6061-T6 aluminum surface mount plate and allow for 2" of protective surfacing. Posts shall be ProShield finished to a specified color. Aluminum Post Mechanical Properties:

1. Yield Strength (min): 35,000 PSI.
2. Tensile Strength (min): 38,000 PSI.
3. Elongation: 10% in 2 inches.
4. Modulus of Elasticity: 10 x 106 PSI.

- B. Arch Posts: Arch posts shall have the same shape as the posts and be extruded from 6063-T4 aluminum alloy. Roof support flanges shall be of the same shape and material as the panel flanges. Arch shall be formed in a 180-degree arc on a 21" center line radius. Arches shall be secured to standard length posts with solid aluminum sleeves that are tapped to receive (16) 3/8" x 5/8" pinned button head cap screws per arch. Arch posts shall be ProShield finished to a specified color.

2.06 Free Standing Equipment.

- A. Chinning Bar Aluminum DB.
- B. Turning Bar DB.
- C. Welcome Sign.
- D. Single Post Swing Frame 8'-0" Beam Height with Belt Seat ProGuard Chains.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Check areas scheduled to receive play equipment has reached necessary compaction.

3.02 ERECTION

- A. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.
- B. Installation methods shall conform to manufacturer's recommendation for anchorage and attachment of components to each other.
- C. Cut all exposed threads off bolts flush with nut or cut excess and provide an acorn nut.

3.03 ADJUSTMENT AND CLEANING

- A. Adjust and align all components.
- B. Clean exposed surfaces of compartments, hardware, and fittings.
- C. Remove protective maskings. Clean surfaces.
- D. Field touch-up of scratches or damaged enamel finish will not be permitted.
- E. Replace damaged or scratched materials with new materials.

END OF SECTION 11 68 16

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Decorative Panel
 - 2. Metal Bench
 - 3. Seating Rocks
 - 4. Seating Multi-Level Wood Logs

1.02 RELATED REQUIREMENTS

- A. Section 01 6116, Volatile Organic Compound (VOC) Restrictions; for VOC limits pertaining to adhesives, sealants, fillers, primers, and coatings.
- B. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.
- C. Section 32 1600, Site Concrete.
- D. Section 32 9000, Planting.
- E. Section 33 4000, Storm Drainage Utilities.

1.03 REFERENCES AND STANDARDS

- A. California Building Code (CBC), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).
- B. California Green Building Standards Code (CAL Green), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).
- C. ASTM International (ASTM):
 - 1. A36/A36M: Standard Specification for Carbon Structural Steel.
 - 2. A787/A787M: Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing.
 - 3. C150/C150M: Standard Specification for Portland Cement.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Submittal Procedures:
 - 1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
 - 2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.

3. Sustainable Design Submittals shall comply with the additional requirements of Section 01 8113, Sustainable Design Requirements.

B. Coordination:

1. Contractor shall be responsible for the proper installation of all accessories embedded in concrete and for the provision of connections, holes, openings, and similar work necessary to the execution of the work of the trades.

1.05 ACTION SUBMITTALS

A. Shop Drawings:

1. Horizontal and vertical layout of site furnishings applicable to the respective furnishings item.

- B. Product Data: Manufacturer's literature, specifications, installation instructions, maintenance instructions, and footing instructions as applicable for proposed products.

C. Samples:

1. Finishes and integral colors for selection.
2. Manufacturer's full range of colors for Architect's selection.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.

B. Sustainable Design:

1. General:
 - a. Submit information necessary to establish and document compliance with the California Green Building Standards Code.
 - b. Sustainable design submittals are in addition to other submittals.
2. The following information shall be provided:
 - a. Paints and Coatings: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.

- C. Sample of manufacturer's warranty.

1.07 CLOSEOUT SUBMITTALS

- A. Warranty/Guarantee: Submit executed warranty and Subcontractor's guarantee.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Engage experienced subcontractors, with minimum 5 years of experience installing site furnishings similar in material, design, and extent to each type indicated for this Project and with a record of successful in-service performance.

- B. Single-Source Responsibility: Use materials and products of one manufacturer whenever possible.

- C. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- D. Materials, components, assemblies, workmanship and installation are to be observed by the Owner's Project Inspector. Work not so inspected is subject to uncovering and replacement.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Site furnishings shall be delivered in good condition in original unopened packages with labels intact and unloaded at job site in such a manner that no damage occurs to the product during hauling, handling or unloading at the job site.
- B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the Work.
- C. Transport, store and handle in strict accordance with the manufacturer's written instructions and recommendations.

1.10 FIELD CONDITIONS

- A. Make and be responsible for field dimensions necessary for proper fitting and completion of work. Report discrepancies to Architect before proceeding.

1.11 WARRANTY

- A. Manufacturer: In addition to the Contractor's and Subcontractor's Guarantee, furnish Owner with manufacturer's fully executed written warranties against defects in materials and workmanship as available.

PART 2 - PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Sustainable Design:
 - 1. VOC emissions for field-applied paints and coatings must comply with limits specified in Section 01 6116.

2.02 DECORATIVE PANEL

- A. As indicated on Drawings

2.03 VARIOUS SEATING

- A. Metal Bench
 - 1. Patterson-Williams 3108-06 Steel Strap Bench with Back.
 - a. Powder coated Light Green

- B. Seating boulders
 - 1. As indicated on Drawings.
- C. Wood seating log
 - 1. Sitting Pole, Natural - Untreated, Item #NR0209-0601 in by Kompan in various lengths.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of the work of this Section, carefully examine and verify that installed work of other trades is complete to the point where this installation may properly commence.
- B. Verify that specified items may be installed in accordance with the approved design.
- C. Do not proceed with installation until conditions for installation are satisfactory.

3.02 INSTALLATION

- A. General:
 - 1. Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the Drawings and as herein specified.
 - 2. Furnish anchors, bolts, and appurtenances required as provided or recommended by manufacturer for installation to ensure proper fit and accurate placements.
- B. Locate equipment furnishing as indicated on the Drawings. If not shown, locate in accordance with shop drawings and as approved by Architect.
- C. Install site furnishings level, plumb, true, and securely anchored and positioned at locations indicated on the Drawings.
- D. Cover all exposed fasteners with integral cover plates or applied vandal-proof covers, so there are no rough or protruding edges which can cause injury.

3.03 CLEANING AND ADJUSTING

- A. Upon completion of installation, remove manufacturer's temporary labels and marks of identification.
- B. Thoroughly wash surfaces and remove foreign material.
- C. Galvanized metal that is cut, damaged, or modified after fabrication shall be immediately painted with zinc-rich paint to prevent rusting.
- D. Leave entire work in neat, orderly, clean and acceptable condition.

3.04 PROTECTION

- A. Protect work and materials of this Section prior to and during installation and protect the installed work and materials of other trades.
- B. Exposed finishes shall be free from scratches, dents, permanent discolorations and other defects in workmanship or material.
- C. In the event of damage, make repairs or replace damaged items to the approval of the Architect at no additional cost to the Owner.

END OF SECTION

SECTION 22 00 50
BASIC PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Electric motors.
2. Motor starters.
3. Strainers.
4. Valve boxes.
5. Gauges.
6. Thermometers.
7. Access Doors.
8. Expansion loops.
9. Flexible joints.
10. Insulation.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 22 Section.

1.03 ADDITIONAL REQUIREMENTS

- A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.
- C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.04 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. CSA – Canadian Standards Association International.
 2. ANSI - American National Standards Institute.
 3. ASTM - American Society for Testing and Materials.
 4. CCR - California Code of Regulations.
 - a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.
 5. NCPWB - National Certified Pipe Welding Bureau.
 6. CEC - California Electrical Code.
 7. NEMA - National Electrical Manufacturers' Association.
 8. NFPA - National Fire Protection Association.
 9. OSHA - Occupational Safety and Health Act.
 10. UL - Underwriters' Laboratories, Inc.
- B. Requirements of Regulatory Agencies:
1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2022.
 - b. California Electrical Code, 2022.
 - c. California Energy Code, 2022.
 - d. California Fire Code, 2022.
 - e. California Green Building Standards Code, 2022.
 - f. California Mechanical Code, 2022.
 - g. California Plumbing Code, 2022.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - l. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.
 - n. Other applicable state laws.
 2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.05

DRAWINGS

- A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.

1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
 2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
 3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
 4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06

FEES AND PERMITS

- A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.
 1. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.
- C. Prior to the start of construction, contact local gas company representative and coordinate location of gas meter and piping. In addition, coordinate time required for installation, in order to avoid delay to the Project.
- D. Coordination:
 1. General:

- a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.
2. Electrical Coordination:
 - a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
 - 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.
3. Mechanical Coordination:
 - a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
 - b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
 - c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 - d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.07 SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.
- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of

disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.

1. Partial or incomplete submittals will not be considered.
 2. Quantities are Contractor's responsibility and will not be reviewed.
 3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
 5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 6. Organize submittals in same sequence as in Specification Sections.
 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.
1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf

binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.08 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.]
 - 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.]
- D. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.
- E. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 - 1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
 - 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 - 3. Supports, anchorages and restraints for piping, ductwork, and equipment shall be an HCAI pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment

must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation. Gas pipe bracing shall be designed in accordance with California Building Code Section 1615A.1.22 and ASCE 7-10 Section 13.6. Coefficient $I_p = 1.5$ shall be used for gas piping bracing calculations.

- b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2016 California Building Code
4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.09 INFORMATIONAL SUBMITTALS

- A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Division 01 for complete instructions.
2. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - 3) Record Drawings.
 - 4) Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
 - 6) Copies of guarantees/warrantees for each item of equipment and systems.

- 7) Test data and system balancing reports.
- 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
- 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
- 10) Control diagrams and literature.
- 11) A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
- 12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
- 13) Commissioning and Preliminary Operation Tests required as part of the Work.

- b. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Project Inspector for all record drawings.

1.11 SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.
- C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is the Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.
- G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12

QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with plumbing systems work similar to that required for this Project.
- C. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service

shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

- D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.
- E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.
- B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor's Standard Guarantee.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with the warranty requirements within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

1.16 REFERENCE STANDARDS

- A. ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2010.

- B. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. NEMA MG 1 - Motors and Generators; 2021.

PART 2 PRODUCTS

2.01 GENERAL

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.02 MATERIALS AND PRODUCTS

- A. No material installed as part of this Work shall contain asbestos.
- B. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.03 VALVE BOXES

- A. General:
 - 1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular "vault" type adequately sized for condition and similar in construction to those specified above.
 - 2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
 - 3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.
- B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.
- C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

- D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.04 GAUGES

- A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.05 THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
 - 1. Provide extension for insulation.
 - 2. Provide thermometers with steel bulb chambers and brass separable sockets.
- B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.06 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 - 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.
- D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.07

THERMAL AND SEISMIC EXPANSION LOOPS

- A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend. Return bend section shall have support lug and plugged FPT drain. Flexible hose shall consist of corrugated metal inner hose and braided metal outer sheath. Assemblies shall be constructed from materials compatible with the fluid or gas being conveyed and shall be suitable for the system operating pressure and temperature. Provide assembly selected for 4 inches of movement.
- B. Provide CSA certified expansion loops for use in natural or propane gas piping systems.
- C. Where used in potable water systems, provide expansion loops of certified lead-free construction.
- D. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex Inc., Metraloop series, or comparable product by one of the following, or equal:
 - 1. Flexicraft Industries.

2.08 FLEXIBLE JOINTS

- A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.
- B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.09 PIPE GUIDES

- A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.10 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.11 PIPE IDENTIFICATION

- A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.
- B. The legends and flow arrows shall conform to ASME A13.1.

2.12 INSULATION WORK

- A. General:
 - 1. For insulating domestic hot water pumps, refer to Section 22 50 00, Plumbing Equipment,
 - 2. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
 - 3. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 - 4. The term "piping" used herein includes pipe, valves, strainers and fittings.
 - 5. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.

6. Provide pre-formed PVC valve and fitting covers.
 7. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
 8. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
 9. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
 10. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.
- B. Insulation of Piping:
1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:
 - a. Pipe 3/4 inches and smaller: 1 inch thick.
 - b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.
 - c. Pipe 2 inches and larger: 2 inches thick.
 2. Insulate domestic hot water piping under slab on grade with Owens Corning Foamglas, preformed pipe insulation, or equal. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Cover pipe and fittings with insulation manufacturer's recommended jacketing. Insulation thickness shall be the following:
 - a. Pipe 3/4 inches and smaller: 2 inches thick.
 - b. Pipe 1 inch and larger: 3 inches thick.
 3. Insulate domestic cold water piping located within building, outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
 4. Insulate domestic cold water piping located outside building exposed to weather with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness for all pipe sizes: 2 inches.
 5. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
 6. Insulate condensate drain piping in freezer with 3/4 inch thick Therma-Cel, Armaflex, or equal. Seal water tight per manufacturer's directions. Install heat tape prior to insulation of piping, in accordance with manufacturer's directions.
 7. Insulate electrically heat-traced grease waste piping under slab on grade with Owens Corning Foamglas, preformed pipe insulation, or equal. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically

- sealed cells. Cover pipe and fittings with insulation manufacturer's recommended jacketing. Insulation thickness for all pipe sizes: 3 inches.
8. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor's option.
 9. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.
 - a. Fitting covers:
 - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 2) Tee covers.
 - 3) Flange and union covers.
 - 4) End caps.
 - 5) Beveled collars.
 - 6) Valve covers.
 - 7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 - b. Jacket thickness:
 - 1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
 - 2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 EXECUTION

3.01 EXISTING MATERIALS

- A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.
- B. Removed materials which will not be re-installed and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.
- C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.
- D. Existing piping, ductwork, and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.02 FRAMING, CUTTING AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.
- C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.
- D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.
- E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.03 PLUMBING DEMOLITION

- A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.
- B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
 - 3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.04 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.05 PIPING SYSTEM REQUIREMENTS

- A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.06 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and Painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
 - 3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.07 EXCAVATING

- A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.
- B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by

hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

- C. Maintain all warning signs, barricades, flares, and red lanterns as required.
- D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.08 BACKFILLING

- A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.
- B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.
 - 1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.
- C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

- D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.09 PIPING SYSTEMS INSTALLATION

- A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.
- B. General:
 - 1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
 - 2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
 - 3. Install piping to permit application of insulation and to allow valve servicing.
 - 4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
 - 5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
 - 6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
 - 7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
 - 8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
 - 9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
 - 10. Install horizontal valves with valve stem above horizontal.
 - 11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
 - 12. Verify final equipment locations for roughing-in.
 - 13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
 - 14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete

between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.

15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.
16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Expansion Loops:

1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

D. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

E. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:

1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.

2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.
 3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
 4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
 5. All above Systems to be installed in strict accordance with manufacturer's instructions.
 6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.
- G. Flashing:
1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. Elmdor/Stoneman Model 1540, 1550, 1570, or equal.
 2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4, 1100-5, 1100-7, or equal.
- H. Hangers and Supports:
1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers. Hanger and support components shall support weight of equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The

Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.

- a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - 1) Provide copper-plated or felt-lined hangers for use on copper tubing.
- 2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
- 3. Riser clamps: B-line model B3373, or equal.
- 4. Pipe Hanger and Support Placement and Spacing:
 - a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Steel Gas	Copper Brazed or Soldered (Note 3)	CPVC & PVC (Note 2)
1/2 - 1"	12 ft.	6 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- 1) Note 1: Provide mid-story guides.
- 2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- 3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

- b. Vertical cast iron piping support spacing: Base and each floor not to exceed 15 feet.
- c. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Steel Gas	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	10 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	10 ft.	4 ft.

- 1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- 2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- 3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

- d. Horizontal cast iron piping support spacing:
 - 1) Support piping at every other joint for piping length of less than 4 feet.
 - 2) For piping longer than 4 feet, provide support on each side of the coupling, within 18 inches of each joint.
 - 3) Hanger shall not be installed on the coupling.
 - 4) Provide support at each horizontal branch connection.
 - 5) Provide sway brace at 40 foot maximum spacing for suspended pipe with no-hub joints, except where a lesser spacing is required by the seismic design criteria used in delegated design for seismic systems. Refer to Article, Submittals.
 - 6) Provide a brace on each side of a change in direction of 90 degrees or more.

5. Suspended Piping:

- a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return

piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

- b. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.
 - c. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
 - d. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.
 - e. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
 - f. Steel Connectors: Beam clamps with retainers.
6. Support to Structure:
- a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.
 - 1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062---MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

- 2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
 - 3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.
- b. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.
7. Rubber Neoprene Pipe Isolators:

- a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.
 - b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
 - c. Acceptable Suppliers:
 - 1) Vertical runs: Acousto-Plumb or equal.
 - 2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
8. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
 9. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
 10. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
 11. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
 12. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.10 UNION AND FLANGE INSTALLATION

- A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.
- B. Install unions in piping NPS 2" and smaller, and flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.
- C. Locate the unions for easy removal of the equipment, tank, or valve.

3.11 ACCESS DOOR INSTALLATION

- A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers,

traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.12 CONCRETE WORK

- A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.
- B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.13 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
 - 1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Royston Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Royston Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 - 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-10 or V-20", "Scotchwrap 50", Slipknot 100, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.
- E. Sleeve copper piping/tubing installed below slab with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer's recommendations and instructions.
- F. Sleeve copper piping/tubing installed outside building below grade with "Polywrap-C" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer's recommendations and instructions.
- G. Sleeve cast iron and ductile iron pipe below grade and below slab with "Polywrap" polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer's recommendations and instructions.
- H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.14

PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.
- B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
 1. Apply legend and flow arrow at approximately 10'-0" intervals in science classrooms and science prep rooms.
- C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.
- D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.
- E. Apply markings after painting and cleaning of piping and insulation is completed.

3.15 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Refer to Structural Drawings.
- B. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer's recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.
- C. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.
- D. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.
- E. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.16 PIPING SYSTEM PRESSURE TESTING

- A. General:
 - 1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.
 - 2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:
 - 1. Authority having jurisdiction shall witness tests of piping systems.
 - 2. Notify Architect at least seven days in advance of testing.
 - 3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
 - 4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
 - 5. Isolate from system equipment that may be damaged by test pressure.

- 6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.
 - a. Authority having jurisdiction shall witness final connection to system.]
- C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.
- D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer’s recommendations. Test to 10 feet above highest point in the system.

System Tested	Test Pressure PSI	Test With
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid
Compressed Air	200 lb.	Air & Non-corrosive Leak Test Fluid
Deionized Water	50	Water

- 1. Flush deionized water lines with deionized water after test and approval.
- 2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.17

TRACER WIRES

- A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #14 tracer wire with low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints. Tracer wire insulation shall be colored yellow for gas piping, blue for water piping.
- B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

- C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than 1/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.18 OPERATION OF SYSTEMS

- A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:
 - 1. Complete all requirements listed under "Check, Test and Start Requirements."
 - 2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 - 3. Filters, strainers etc. are in place.
 - 4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 - 5. Equipment has been run under observation, and is operating in a satisfactory manner.
- B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

3.19 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
 - 1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 - 2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 - 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 - 4. When work has been completed, provide copies of reports for review, prior to final observation of work.

- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.20 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
 - 1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
 - 2. Correct rotation of motors and ratings of overload heaters are verified.
 - 3. Specified filters are installed and spare filters have been turned over to Owner.
 - 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 - 5. All equipment has been cleaned, and damaged painted finishes touched up.
 - 6. Missing or damaged parts have been replaced.
 - 7. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 - 8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
 - 9. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 - 10. Preliminary test and balance work is complete, and reports have been forwarded for review.
 - 11. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 - 12. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
 - 1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.

2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
 3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
 4. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.
- C. Review of Contractor's Tests:
1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.
- D. Test Logs:
1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.
- E. Preliminary Operation:
1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.21 CERTIFICATES OF INSTALLATION

- A. Contractor shall complete applicable "Certificates of Installation" forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.22 DEMONSTRATION AND TRAINING

- A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
 2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.

3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
 - a. Listing of Owner-designated personnel completing training, by name and title.
 - b. Name and title of training instructor.
 - c. Date(s) of training.
 - d. List of topics covered in training sessions.
4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

1.02 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 90 00 - Paints and Coatings: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.04 SUBMITTALS

- A. See Section 00 72 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

2.01 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Seton Identification Products: www.seton.com/aec.

2.02 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.

2.03 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.

2.04 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 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 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. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- D. Service Markers: Identify buried plugged or capped pipe with concrete marker, 4 inch diameter by 30 inches long, set flush with grade. Provide engraved brass nameplate identifying pipe stub.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 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. Apply stencil painting in accordance with Section 09 90 00.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify domestic hot water heating equipment, including water heaters, pumps, expansion tanks, etc. with plastic nameplates.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.
- J. 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.
- K. Provide red ceiling dots to locate valves above T-bar type panel ceilings. Locate in corner of T-bar panel closest to equipment.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Valves.
3. Domestic water piping specialties.
4. Drain and waste piping specialties.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Plumbing Materials and Methods.

1.03 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.04 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Plumbing Materials and Methods.
- B. Provide welding certificate for all gas pipe welders.
- C. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

1.05 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Plumbing Materials and Methods.

- B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.07 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Gas Pipe Installer Qualifications: Individuals performing tasks requiring qualifications under Federal and State regulations shall be qualified by the gas utility supplying Project site. The qualifications shall be current at the time of performing the Work.
- C. NFPA/ANSI Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54/ANSI Z223.1 "National Fuel Gas Code."
- D. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- E. Fabricate and install natural gas systems in accordance with California Plumbing Code.
- F. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

1.08 REFERENCE STANDARDS

- A. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges; 2021.
- B. ASME B31.1 - Power Piping; 2022.
- C. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- D. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- E. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2020.
- F. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

- G. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
- H. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2020.
- I. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.
- J. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.
- K. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.
- L. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing; 2016.
- M. ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems; 2016.
- N. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
- O. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.
- P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.
- Q. 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; 2020.
- R. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.
- S. MSS SP-67 - Butterfly Valves; 2022.
- T. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
- U. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
- V. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

- W. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
- X. NFPA 54 - National Fuel Gas Code; 2024.

PART 2 PRODUCTS

2.01 MATERIALS AND PRODUCTS

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.02 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

- A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.
- B. Drain and Waste Pipe Above Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, vertical piping above floor from lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV weld pipe and fittings.
 - 1. Joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more. Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).
- C. Drain and Waste Pipe Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.

1. Joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.
 2. Joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.
- D. Vent Pipe:
1. 3 inch and larger: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe above grade.
 2. 2-1/2 inch and smaller: Cast iron soil pipe and fittings as specified for sizes 3 inch and larger, Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.
 3. Vent pipe buried in ground and to 6 inches above ground: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.
- E. Type DWV copper tubing or No-Hub cast iron pipe and fittings may be used for concealed rainwater leaders. Where no-hub piping is used, the fittings and couplings shall match those used for waste piping.
- F. Grease Waste (GW) and Vent (GV) Pipe Underground to 6 Inches Aboveground: George Fisher Sloane, Inc., "Fuseal PP," Orion Fittings, Inc., "Rionfuse CF," IPEX, Inc., "Enfield," or equal, Schedule 40 polypropylene pipe and fittings assembled with electrofusion joints. Piping shall comply with ASTM F1412.
- G. Grease Waste (GW) and Vent (GV) Pipe Aboveground:
1. In inaccessible spaces or within walls, George Fisher Sloane, Inc., "Fuseal PP," Orion Fittings, Inc., "Rionfuse CF," IPEX, Inc., "Enfield," or equal, flame-retardant schedule 40 polypropylene pipe and fittings assembled with electrofusion joints. Piping shall comply with ASTM F1412.
 2. In accessible areas: George Fisher Sloan, Inc. "Fuseal PP," Orion Fittings, Inc. "Blueline," IPEX, Inc. "Labline," or equal, flame retardant Schedule 40 polypropylene drainage pipe and fittings, with mechanical joints. Piping shall comply with ASTM F1412.
 3. Vent pipe aboveground: 3 Inches and Larger: Service weight cast iron soil pipe and fittings; 2-1/2 inches and smaller: Schedule 40 galvanized steel pipe with black cast iron drainage fittings.
- H. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K

annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.

- I. Temperature and Pressure Relief Valve Piping: ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass.

2.03

PIPE JOINING MATERIALS

- A. Refer to piping Articles in this Section for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated
 - a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.
 2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
 3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.
 4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, 100 percent lead free alloys. Include water-flushable flux according to ASTM B813.
- D. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
- E. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Solvent Cements for Joining CPVC Piping: ASTM F 493.
 1. CPVC solvent cement shall have VOC content of 490 g/L or less.
 2. Adhesive primer shall have VOC content of 550 g/L or less.
 3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 1. PVC solvent cement shall have VOC content of 510 g/L or less.
 2. Adhesive primer shall have VOC content of 550 g/L or less.
 3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.04 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:

1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 11 68 75.
 - a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.
 - 1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 11 68 75.

B. Gate Valves:

1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.
2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.
3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.
4. Main distribution gate valves underground outside building above 1-1/2 inches:
 - a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.
 - 1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - 2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:

1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.
2. 2-1/2 inches: Apollo 77C-LF10, or equal.

2.05 DOMESTIC WATER PIPING SPECIALTIES

A. Hose Bibbs:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. Acorn Engineering Co.
 - b. Woodford Manufacturing Co.
 2. Hose Station: Leonard THS-25-VB-CW, Symmons, or equal.
- B. Water Hammer Arrestors:
1. Provide water hammer arrestors conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Water hammer arrestors shall be sized for type and number of fixtures served. Provide all stainless steel shell construction with stainless steel bellows and threaded connection to water system.
 2. Water hammer arrestors shall be certified under P.D.I. Standard WH201 and by ASSE Standard 1010.
 3. Select units in accordance with the requirements of Plumbing and Drainage Institute Standard P.D.I. WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.
 4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Josam Company, series 75000.
 - b. Smith (Jay R.) Mfg. Co., Hydrotrol 5005-5050.
 - c. Mifab, series WHB.
- C. Thermostatic Water Temperature Control Valve:
1. Provide thermostatic water temperature control valve conforming to lead free requirements of California Health and Safety Code Section 11 68 75, with size as noted on Drawings, complete with union angle strainer checkstops. Valves shall be thermostatic type, with a maximum temperature setting as follows:
 2. Provide surface recessed semi-recessed mounted, white enameled or stainless steel cabinet with locking door for control valves. Including:
 - a. Control valve cabinet and valve shall be provided as a package, and include thermostatic water mixing valve, thermometer, safety checkstops, volume control valve and internal piping.
 3. Where indicated on drawings, provide a temperature alarm system, utilizing a micro-processor based controller and solid state temperature controller. Provide audible and visual indication of high and low temperature set points. Provide required hardware and wiring for a complete operating system.
 - a. Provide isolation transformer for control of the alarm system.
 - b. Provide solenoid valve and shock absorber, installed and wired to the alarm module.

4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Leonard Valve Company.
 - b. Lawler Manufacturing Co., Inc.
 - c. Powers.

D. Trap Primers:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. MiFab, Inc.
 - b. Precision Plumbing Products.
 - c. Sioux Chief Manufacturing Company.

2.06

DRAIN AND WASTE PIPING SPECIALTIES

A. Cleanouts:

1. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and whenever sanitary sewer exits building. All two-way cleanouts shall have (2) risers, each in opposing directions.
 - a. Provide cleanouts in waste drop from each sink and urinal.
 - b. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.
2. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.
3. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).
4. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.
5. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within ½ inch of front face of finished wall.
 - a. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.
 - b. Install face of cleanout plug within 1/2 inch of front face of finished wall.
6. Cleanouts exterior to building in landscaped areas: Zurn Z-1449-BP, or equal, cleanout ferrule with tapered bronze plug. Where located at grade, provide 18

by 18 by 6 inch concrete pad; Trowel concrete smooth and edge; set flush with finished grade.

7. Cleanouts in drive areas: Zurn -1400-HD-KC, or equal, with heavy-duty top and ABS plastic plug.
 8. Cleanouts in acid waste systems: Zurn ZN-1404, or equal, cleanout access housing, with ductile cast iron body and nickel bronze top. Extend acid waste piping within the cleanout, and terminate with threaded cap. Secure acid waste pipe inside cleanout access housing with setscrews provided.
- B. Floor Drains:
1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. MIFAB.
 - c. Watts.
 - d. Zurn.
- C. Floor Sinks:
1. Floor Sinks: Provide anchoring flange (seepage pan) at all floor sinks, and provide flashing clamp in locations where floor membrane is used. Provide cast iron "P" trap and trap primer connection at P-Trap.
 2. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
 - a. J.R. Smith.
 - b. MIFAB.
 - c. Watts.
 - d. Zurn.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.
- B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.
- C. Determine sanitary sewer and storm drain location and elevation at all points of connection before installing any piping. Notify Architect immediately if indicated grades cannot be maintained.

- D. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.02 INSTALLATION OF WATER PIPING

- A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.
- B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.
 - 1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.
 - 2. Install water hammer arrestors above accessible ceilings, or install access doors for service.
- C. In freezing locations arrange water piping to drain as shown.]
- D. Install piping on room side of building insulation.
- E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.]
- F. For all faucets, hose bibbs, or other water outlets delivering industrial hot and/or cold water, provide a sign, permanently mounted, indicating "CAUTION: NON-POTABLE WATER, DO NOT DRINK". Each sign shall be permanently engraved with black uppercase letters on a yellow background. Letters shall be minimum 1-1/4 inch high.]

3.03 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

- A. Make joints in PVC sewer pipe with PVC-type couplings and rubber rings.
- B. Check final location of rubber rings within the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.

1. Ring-Tite cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the pipe with PVC couplings.
- C. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- D. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.
- E. Install rainwater leader nozzles at exposed bottom of leaders where they spill onto grade.
- F. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.
- G. Grade all vent piping so as to free itself quickly of any water condensation.
- H. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.
- I. Install drip pan under storm drain piping, sanitary drain piping, and vent piping that must be run over kitchen areas.
- J. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.04 INSTALLATION OF GREASE WASTE PIPING SYSTEMS

- A. Install to comply with all manufacturers' recommendations.
- B. All buried pipe shall be bedded in and backfilled with 4 inches of sand, and installed as recommended by manufacturer.
- C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Maintain continuous pressure test on piping installed below grade, until all work has progressed to above grade.
- D. Electrofusion joints: Make polypropylene drainage piping joints according to ASTM F 1290.

3.05 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Threaded Pipe: 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 thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

E. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.

1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.

F. Cast Iron Soil Pipe:

1. No-Hub fittings shall be made with a torque wrench.
2. Hub joints shall be with Ty-Seal couplings.
3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.
4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified LOP reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.

G. Welded Pipe:

1. Make up with oxyacetylene or electric arc process.
 2. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.
 3. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.
- H. PVC Sewer and Drainage Pipe (outside building as allowed only): Four inches and larger shall be bell and spigot, assembled in accordance with manufacturer's recommendations. Joint shall be tested in accordance with ASTM D3212. Solvent weld joints below 4 inches in size, schedule 40 PVC with matching fittings, assembled per manufacturer's instructions.
- I. Make joints in PVC water pipe with PVC couplings and rubber rings, Manville Ring-Tite, PW Pipe, or equal. Check final location of rubber rings with the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron or PVC adapter fittings, installed as recommended by the manufacturer. Ring-Tite PVC or cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the water pipe with PVC couplings.
- J. Flexible Connections:
1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
 2. Anchor piping securely on the system side of each flexible connection.

3.06

INSTALLATION OF VALVES

- A. Install valves as indicated on Drawings and in the following locations:
1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
 2. 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 indicated or required to completely drain potable water system.
 3. Provide gate or globe valves on inlet and outlet of each water heater or pump.
- B. General:
1. Valves shall be full line size unless indicated otherwise on Drawings.
 2. Install horizontal valves with valve stem above horizontal, except butterfly valves.
 3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
 4. Locate valves for easy access and provide separate support where necessary.

5. Install valves in position to allow full stem movement.
 6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
 7. Butterfly valves conforming to the paragraph "Butterfly Valves" may be used in lieu of gate or globe valves for locations above grade.
 8. Ball valves conforming to the paragraph "Ball Valves" may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.
 9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.
 10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.
- C. Gate Valves:
1. Furnish valves in copper lines with adapters to suit valve / line requirements.
 2. Underground gate valves:
 - a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
 - b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.
- D. Swing Check Valves: Install in horizontal position with hinge pin level.
- E. Butterfly Valves: Install with stems horizontal.
- F. Silent Check Valves: Install in horizontal or vertical position between flanges.
- G. Calibrated Balancing Valves: Install calibrated balancing valves per manufacturers' recommendations, including requirements for straight pipe lengths at valve inlet and outlet.
- H. Valve Adjustment: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.07 INSTALLATION OF CLEANOUTS

- A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.
- B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.08 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

- A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate with other trades to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.
- B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.09 TRAP PRIMER INSTALLATION

- A. Install as indicated in manufacturers printed literature, with 1/2 inch, Type L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings. At Contractor's option, Type K annealed copper tubing without joints may be used below slab only. See Section 22 00 50 for pipe protection requirements for below slab copper piping/tubing.
- B. Install trap primer piping with 1/4 inch per foot slope, to insure that the line will drain fully to the floor drain or floor sink.
 - 1. Provide ball valve to the inlet at each trap primer location.
- C. Install trap primer and distribution unit exactly as called for in manufacturers printed installation instructions. Connect to domestic water piping from the top of the water line, in order to prevent foreign material from entering directly into primer assembly.
- D. Mount trap primer in wall, in sheet metal box, with Karp or equal access door. Size access door and box to suit valve operation, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door where installed in occupied spaces.
- E. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.

3.10 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.

- B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

3.11 KITCHEN EQUIPMENT INSTALLATION

- A. Coordinate all work with Specification Section for kitchen equipment.
- B. All equipment shall be fully connected.
- C. Furnish and install all required "P" traps.
- D. Provide stops on all hot and cold water lines at equipment, in an accessible position. Include lines to kettle and range swing faucets.
- E. All floor openings are to be sealed watertight.
- F. Indirect waste lines required for standard or fabricated items of kitchen equipment, except sinks, shall be furnished and installed by the kitchen equipment contractor.
- G. Provide all sink drains. All indirect drains shall terminate above floor sinks at least 1-1/2 times ID of drain line and shall be so set that flare will not spill on floor area.
- H. Provide approved vacuum breaker or anti siphon device on water lines to equipment wherever required.
- I. The kitchen equipment contractor will provide all equipment trim including faucets and sink wastes and swing faucets at kettles all to be installed by Plumbing contractor.
- J. All horizontal piping lines connected to equipment shall be run at the highest possible elevation not less than 6 inches above floor. Piping rough-in shall be stubbed in walls wherever possible.
- K. Vent piping for waste lines shall be concealed wherever possible and vertical vents for island or free-standing equipment shall be avoided. Any required exposed vents shall be submitted to the Architect for approval.

3.12 DOMESTIC WATER SYSTEM STERILIZATION

- A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.

1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.13 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.14 OPERATIONAL TESTS

- A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.15 TESTING AND BALANCING

- A. See Section 23 05 93 of Specifications for testing and balancing requirements.

3.16 CLEANING UP

- A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Water supplies and stops.
 - 2. Plumbing fixture hangers and supports.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 22 00 50 Basic Plumbing Materials and Methods.

1.03 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

1.04 INFORMATIONAL SUBMITTALS

- A. Refer to Section 22 00 50, Basic Plumbing Materials and Methods.

1.05 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

1.06 QUALITY ASSURANCE

- A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

- B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this Section:
 - 1. 2022 California Building Code – CBC
 - 2. 2022 California Plumbing Code – CPC
 - 3. 2022 California Health and Safety Code
 - 4. American National Standards Institute - ANSI
 - 5. Federal Standards - F.S.
 - 6. National Sanitary Foundation – NSF International
- C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”
- D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.
- E. UL Labels: Provide water coolers that have been listed and labeled by Underwriters' Laboratories.
- F. ARI Labels: Provide water coolers that are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.
- G. Americans with Disabilities Act (ADA).
- H. California Green Building Standards Code Requirements:
 - 1. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets.
 - 2. Single Showerheads shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Showerheads.

1.07 REFERENCE STANDARDS

- A. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- B. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

PART 2 PRODUCTS

2.01 PLUMBING FIXTURES

- A. General: Provide factory fabricated fixtures of type, style and material indicated. 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 the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is

Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.

1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.
2. Take location and mounting heights for roughing-in from Architectural Drawings.
3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.
4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.02 MATERIALS

- A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.
- C. Handles on all faucets and stops shall be all metal chromium plated.
- D. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.
 1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
- B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.
- C. Carriers: Provide cast iron supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated. Where the carrier for wall mounted water closets are

installed more than 6 inches behind the finished wall, provide water closet support for wide pipe chase.

- D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.
- F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.
- G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.04

MANUFACTURERS

- A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.
- B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:
 - 1. Vitrified China Plumbing Fixtures:
 - a. American Standard, U.S. Plumbing Products.
 - b. Eljer Plumbingware Div., Wallace-Murray Corp.
 - c. Kohler Co.
 - d. Vitra.
 - 2. Modular Lavatories:
 - a. Bradley.
 - b. Acorn.
 - c. Willoughby Industries, Inc.
 - 3. Plumbing Trim:
 - a. McGuire Manufacturing Co., Inc.
 - b. Delta Commercial.
 - c. Chicago Faucet Co.
 - d. T&S Brass and Bronze Works, Inc.
 - 4. Flush Valves:
 - a. Sloan Valve Co.
 - b. Zurn Industries, Hydromechanics Div.
 - c. Toto USA, Inc.
 - 5. Faucets:
 - a. Chicago Faucet Co.
 - b. Symmons Scott.
 - c. T&S Brass and Bronze Works, Inc.

- d. Delta Commercial.
- 6. Fixture Seats:
 - a. Church Seat Co.
 - b. Bemis Mfg. Co.
 - c. Beneke Corp.
- 7. Water Coolers and Drinking Fountains:
 - a. Murdock
 - b. Haws Corporation.
- 8. Fixture Carriers:
 - a. Josam Mfg. Co.
 - b. J. R. Smith.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Industries; Hydromechanics Div.
 - e. Mifab, Inc.

2.05 FLUSH VALVE REQUIREMENTS

- A. Metering flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered bypass and be chloramine resistant synthetic rubber with internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable.
- B. Electronic flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered by pass and be chloramine and resistant synthetic rubber with rubber and internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable. All flush valve solenoids and sensors shall be UL listed.

2.06 FIXTURE CONNECTIONS

- A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.
- B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

- a. Dearborn Brass, Commercial series with brass nuts.
 - b. Delta Commercial.
 - c. McGuire Manufacturing Co., Inc.
- C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.
- D. Plumbing fixture traps connected to special waste systems shall be constructed of materials to suit the waste system.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Orion.
 - b. Enfield
- E. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.07 WATER SUPPLIES AND STOPS

- A. Provide 85 percent IPS threaded red brass nipple, conforming to the lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.
- B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.
- C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.
- D. Provide cast brass escutcheon.
- E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. McGuire Manufacturing Company, Inc., model LFH2167LK.
2. T & S Brass and Bronze Works, Inc., model B-1305.

2.08 PLUMBING FIXTURE HANGERS AND SUPPORTS

- A. Floor-affixed supports for off-the-floor plumbing fixtures shall comply with ASME A112.6.1M.
- B. Residential type fixture supports are not acceptable.
- C. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.
- D. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.
- E. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
 1. Wall hung lavatories.
 2. Wall mounted urinals.
 3. Drinking fountains.
 4. Electric water coolers.

2.09 PLUMBING FIXTURES

- A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.
- B. Special Requirements For Accessible Fixtures:
 1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.
 2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded "closed-cell" vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.

PART 3 EXECUTION

3.01 PRODUCT HANDLING AND PROTECTION

- A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.02 PREPARATORY PROVISIONS

- A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.03 INSPECTION AND PREPARATION

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also 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. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.
- E. Refer to Division 26 for wiring for electronic flush valves.]

3.04 FAUCET INSTALLATION

- A. Provide 85 percent IPS red brass pipe, conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to faucets, stops, hose bibbs, etc. Each fixture,

except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.

- B. Adjust metering faucets to run for 10 to 15 seconds.

3.05 CLEAN AND PROTECT

- A. Clean plumbing fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.
- C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.06 FIELD QUALITY CONTROL

- A. 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.

3.07 EXTRA STOCK

- A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units.

END OF SECTION

SECTION 23 00 50
BASIC HVAC MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Electric motors.
 2. Motor starters.
 3. Strainers.
 4. Gauges.
 5. Thermometers.
 6. Access Doors.
 7. Flexible joints.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. This Section is a part of each Division 23 Section.
- C. Refer to Section 23 08 00. T-24 Commissioning of HVAC for Title 24 commissioning and acceptance testing requirements.

1.03 ADDITIONAL REQUIREMENTS

- A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.
- B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.
- C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.04 REFERENCES AND STANDARDS

- A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1. AABC - Associated Air Balance Council
 2. AFBMA - Anti Friction Bearing Manufacturer's Association
 3. AMCA - Air Moving and Control Association Inc.
 - a. Standard 210 - Laboratory Methods of Testing Fans
 4. ANSI - American National Standards Institute
 5. ARI - Air-Conditioning and Refrigeration Institute
 6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
 7. ASME - American Society of Mechanical Engineers
 8. ASTM - American Society for Testing and Materials
 9. CCR - California Code of Regulations
 - a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
 10. CSA – Canadian Standards Association International
 11. CSFM - California State Fire Marshal
 12. NCPWB - National Certified Pipe Welding Bureau
 13. NIST - National Institute of Standards and Technology
 14. NEMA - National Electrical Manufacturers' Association
 15. NFPA - National Fire Protection Association
 16. OSHA - Occupational Safety and Health Act
 17. SMACNA - Duct Manuals
 18. UL - Underwriters' Laboratories, Inc.
- B. Requirements of Regulatory Agencies:
1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
 - a. California Building Code, 2022.
 - b. California Electrical Code, 2022.
 - c. California Energy Code, 2022.
 - d. California Fire Code, 2022.
 - e. California Green Building Standards Code, 2022.
 - f. California Mechanical Code, 2022.
 - g. California Plumbing Code, 2022.
 - h. California Code of Regulations, Title 24.
 - i. California Health and Safety Code.
 - j. CAL-OSHA.
 - k. California State Fire Marshal, Title 19 CCR.
 - l. National Fire Protection Association.
 - m. Occupational Safety and Health Administration.
 - n. Other applicable state laws.
 2. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

1.05 DRAWINGS

- A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.
- B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
 - 1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
 - 2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
 - 3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contractors' expense upon Architects' direction.
 - 4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.
- C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06 FEES AND PERMITS

- A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.
- B. Arrange for utility connections and pay charges incurred, including excess service charges.
- C. Coordination:
 - 1. General:

- a. Coordinate HVAC Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.
2. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.
3. Electrical Coordination:
 - a. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
 - 1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
 - 2) If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
 - 3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.
4. Mechanical Coordination:
 - a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
 - b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
 - c. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 - d. Coordinate with other trades equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to other trades as required for a completely coordinated project.

1.07

SUBMITTALS - GENERAL

- A. Refer to Division 01 Submittals Section(s) for additional requirements.
- B. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

- C. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used.
1. Partial or incomplete submittals will not be considered.
 2. Quantities are Contractor's responsibility and will not be reviewed.
 3. Provide materials of the same brand or manufacturer for each class of equipment or material.
 4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
 5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
 6. Organize submittals in same sequence as in Specification Sections.
 7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
 - a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
 - b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
 - c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
 - d. Catalog cuts and published material may be included with supplemental scaled drawings.
- D. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.
- E. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.

1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.
- F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.08

ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.
- B. Shop Drawings.
- C. Sustainable Design Submittals:
 1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.]
 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.]
- D. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators indicated to comply with performance requirements and design criteria.
 1. Calculations performed for use in selection of seismic supports, anchorages, restraints, and vibration isolators shall utilize criteria indicated in Structural Contract Documents.
 2. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
 3. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an HCAI pre-approved system such as TOLCO, ISAT, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
 - a. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to show

that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

- b. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2016 California Building Code
4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.09 INFORMATIONAL SUBMITTALS

- A. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.
- B. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.
- C. Check, Test, and Start forms, from equipment manufacturers.
- D. Check, Test and Start reports.

1.10 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 1. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Begin compiling data upon approval of submittals.
 - a. Sets shall incorporate the following:
 - 1) Product Data.
 - 2) Shop Drawings.
 - 3) Record Drawings.
 - 4) Service telephone number, address and contact person for each category of equipment or system.
 - 5) Complete operating instructions for each item of heating, ventilating and air conditioning equipment.

- 6) Copies of guarantees/warranties for each item of equipment or systems.
 - 7) Test data and system balancing reports.
 - 8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
 - 9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
 - 10) Temperature control diagrams and literature.
 - 11) Check test and start reports for each piece of mechanical equipment provided as part of the Work.
 - 12) Commissioning and Preliminary Operation Tests required as part of the Work.
2. Post service telephone numbers and addresses in an appropriate place designated by Architect.
- B. Record Drawings:
1. Refer to Division 01 for additional requirements.
 2. Upon completion of the Work, deliver to Architect the following:
 - a. Originals of drawings showing the Work exactly as installed.
 - b. One complete set of reproducible drawings showing the Work exactly as installed.
 - c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
 - d. Provide Contractor's signature, verifying accuracy of record drawings.
 - e. Obtain the signature of the Inspector of Record for Record Drawings.

1.11

SUBSTITUTIONS

- A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.
- B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

- C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.
- D. Only one request for substitution will be considered for each item of equipment or material.
- E. Substitution requests shall include the following:
 - 1. Reason for substitution request.
 - 2. Complete submittal information as described herein; see "Submittals."
 - 3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
 - 4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
 - 5. Explanation of impact on connected utilities.
 - 6. Explanation of impact on structural supports.
- F. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.
- G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of HVAC systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with HVAC systems work similar to that required for this Project.
- C. Comply with applicable portions of California Mechanical Code pertaining to selection and installation of HVAC materials and products.
- D. All materials and products shall be new.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

- A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.]
- B. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.15 WARRANTY

- A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor's Standard Guarantee.
- B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.
- C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

1.16 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- B. NEMA MG 1 - Motors and Generators; 2021.

PART 2 PRODUCTS**2.01 GENERAL**

- A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.
- B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.
- C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.02 MATERIALS

- A. No material installed as part of this Work shall contain asbestos.
- B. California Green Building Code Compliance:
 - 1. HVAC and refrigeration equipment shall not contain CFCs.
 - 2. HVAC and refrigeration equipment shall not contain Halons.

2.03 ELECTRIC MOTORS

- A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. U.S. Motors.
 - b. Century Electric.
 - c. General Electric.
 - d. Lincoln.
 - e. Gould.
- B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
 - 1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.
- C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
 - 1. Multispeed motors shall have separate windings for each speed.
- D. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
 2. Motors Used with Variable Frequency Controllers:
 - a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - f. Each motor shall be provided with a shaft grounding device for stray current protection.
 3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.
- E. Single-Phase Motors:
1. Select motors with service factor of 1.15.
 2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
 3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:
 - a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.
 - 1) Exceptions:
 - (a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.
 - (b) Motors installed in space conditioning equipment certified under California Energy Code Section 110.1 or 110.2.
 4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.
 5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
 6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
 7. Motors 1/20 HP and Smaller: Shaded-pole type.

8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.04

MOTOR STARTERS

- A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.
- B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
 1. All starters shall have the following:
 - a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
 - b. Ambient compensated thermal overload.
 - c. Fused control transformer (for 120 or 24 volt service).
 - d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
 2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
 3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
 4. Provide OSHA label indicating the device starts automatically.

2.05

THERMOMETERS

- A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
 1. Provide extension for insulation.
 2. Provide thermometers with steel bulb chambers and brass separable sockets.
 3. Thermometers for air temperature shall have 8 inch minimum stem.
- B. Provide Ventlock, Durodyne, or equal thermometer test holes at each air conditioning unit, furnace, and make-up air unit, in mixed air and supply air, and at all locations shown or scheduled on the Drawings. Provide two portable thermometers, with sensing connection arranged to suit test connections.
- C. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.06 ACCESS DOORS

- A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
 - 1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.
- B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.
- C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.
- D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.
- E. Provide insulated doors where located in internally insulated ducts or casings.
- F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.
- G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.
- H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
 - 1. Milcor
 - a. Style K (plaster).
 - b. Style DW (gypsum board).
 - c. Style M (Masonry).
 - d. Style "Fire Rated" where required.

2.07 EQUIPMENT IDENTIFICATION

- A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

PART 3 EXECUTION

3.01 EXISTING MATERIALS:

- A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.
- B. Removed materials which will not be re-installed and which are not claimed by Owner shall become the property of Contractor and shall be removed from the Project site. Consult Owner before removing any material from the Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.
- C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from the premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

3.02 FRAMING, CUTTING, AND PATCHING

- A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.
- B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.
- C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.
- D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.
- E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.03 MECHANICAL DEMOLITION

- A. Refer to Division 01 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

- B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.04 ELECTRICAL REQUIREMENTS

- A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.
- B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.
- C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.05 PIPING SYSTEM REQUIREMENTS

- A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.06 PRIMING AND PAINTING

- A. Perform priming and painting on the equipment and materials as specified herein.
- B. See Division 09 Painting Section(s) for detailed requirements.
- C. Priming and painting:
 - 1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.
 - a. Black Steel Piping:
 - 1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - 2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.
 - b. Interior Ductwork: Refer to Division 09 Painting Section(s). Architect shall select paint color.
 - 2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
 - 3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

3.07 EXCAVATING

- A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.

- B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such 100 percent of the material will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.
- C. Maintain all warning signs, barricades, flares, and red lanterns as required.
- D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.08 BACKFILLING

- A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.
- B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.
 - 1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.
- C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent

relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

- D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.09 UNION AND FLANGE INSTALLATION

- A. Install Epcor, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.
- B. Install unions in piping NPS 2" and smaller 3 or flanges in piping NPS 2-1/2" and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.
- C. Locate the unions for easy removal of the equipment, tank, or valve.
- D. Do not install unions or flanges in refrigerant piping systems.

3.10 ACCESS DOOR INSTALLATION

- A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.11 CONCRETE WORK

- A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.
- B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.12 PIPE PROTECTION

- A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:

1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Royston Products, or equal.
 - a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Royston Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
 2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-10 or V-20", "Scotchwrap 50", Slipknot 100, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.
- B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.
- C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Razor Co. holiday detector, or equal.
- D. Cleaning: Clean all piping thoroughly before wrapping.
1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.
- E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.13

PIPE IDENTIFICATION

- A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.
- B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

1. Apply legend and flow arrow at approximately 10'-0" intervals in science classrooms and science prep rooms.
- C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.
- D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.
- E. Apply the markings after painting and cleaning of piping and insulation is completed.

3.14 EXPANSION ANCHORS IN HARDENED CONCRETE

- A. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer's recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.
- B. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.
- C. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.
- D. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.15 OPERATION OF SYSTEMS

- A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:
 1. Complete all requirements listed under "Check, Test and Start Requirements."
 2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
 3. Filters, strainers etc. are in place.

4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
 5. Equipment has been run under observation, and is operating in a satisfactory manner.
- B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.
- C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.16 TEMPORARY HEAT

- A. The General Contractor will provide for all temporary heat at such times as may be required or directed by the Architect and pay all fuel and energy costs incurred.
- B. Temporary heating facilities proposed for use by the Contractor will be subject to review of the Architect. Prior to use of any equipment for temporary heat, install temporary filters on all return air inlets, to preclude dust and construction debris from entering the duct system. In addition, install filters in air handling units, and replace at the completion of temporary operation.
- C. Filters used for temporary operation of systems shall be as specified for permanent filters specified herein.
- D. Comply with Check, Test and Start Requirements for start-up of equipment prior to operation for temporary heat.
- E. Contractor shall complete the permanent heating system as soon as possible, thereby making it available for temporary heat. When available, the system may be used as required at the direction of the Architect after systems are properly prepared for use as specified elsewhere. Contractor shall then be responsible for operating the system during periods required and the General Contractor shall pay the fuel and energy costs incurred. Operation of the heating system prior to the filing of "notice of completion" shall not change the Guarantee provisions in any way.]

3.17 CHECK, TEST AND START REQUIREMENTS

- A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor.

Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
 2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
 4. When work has been completed, provide copies of reports for review, prior to final observation of work.
- B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.
- C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.18

PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

- A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
 2. Correct rotation of motors and ratings of overload heaters are verified.
 3. Specified filters are installed and spare filters have been turned over to Owner.
 4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
 5. All equipment has been cleaned, and damaged painted finishes touched up.
 6. Damaged fins on heat exchangers have been combed out.
 7. Missing or damaged parts have been replaced.
 8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
 9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.

10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
 11. Preliminary test and balance work is complete, and reports have been forwarded for review.
 12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
 13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.
- B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
 2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
 3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
 4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
 5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.
- C. Before handing over the system to Owner replace all filters with complete new set of filters.
- D. Review of Contractor's Tests:
1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.
- E. Test Logs:
1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.
- F. Preliminary Operation:
1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.
- G. Operational Tests:

1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
 2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
 3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
 4. Control systems shall be completely operable with settings properly calibrated and adjusted.
 5. Rotating equipment shall be in dynamic balance and alignment.
 6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.
- H. Pre-Occupancy Building Purge:
1. Prior to occupancy, ventilate the building on 100 percent outside air, 100 percent exhaust for a continuous period determined by a qualified industrial hygienist (engaged by the Contractor) to reduce V.O.C's prior to occupancy.
 2. Submit report by the industrial hygienist verifying satisfactory completion of the pre-occupancy purge.

3.19

DEMONSTRATION AND TRAINING

- A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
 2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
 3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
 - a. Listing of Owner-designated personnel completing training, by name and title.
 - b. Name and title of training instructor.
 - c. Date(s) of training.
 - d. List of topics covered in training sessions.

4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 23 05 53
MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

1.02 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 90 00 - Paints and Coatings: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.04 SUBMITTALS

- A. See Section 00 72 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

2.01 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Seton Identification Products: www.seton.com/aec.

2.02 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.

2.03 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.

2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Ductwork: Minimum 1-1/4" high letters.
 - 2. Access Doors and Similar Operational Instructions: Minimum 3/4" high letters.
- B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 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. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- D. Service Markers: Identify buried plugged or capped pipe with concrete marker, 4-inch diameter by 30 inches long, set flush with grade. Provide engraved brass nameplate identifying pipe stub.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 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. Apply stencil painting in accordance with Section 09 90 00.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify domestic hot water heating equipment, including water heaters, pumps, expansion tanks, etc. with plastic nameplates.
- G. Identify air conditioning units, makeup air units and exhaust fans with plastic nameplates.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify thermostats relating to fan unit and/or zone unit with nameplates.
- J. Identify valves in main and branch piping with tags.
- K. Tag automatic controls, instruments, and relays. Key to control schematic.
- L. 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.
- M. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- N. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93
 TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCES AND STANDARDS

- A. Associated Air Balance Council (AABC)
 - 1. National Standards for Total System Balance, latest edition.
- B. National Environmental Balancing Bureau (NEBB)
 - 1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.04 DEFINITIONS

- A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.
- B. Similar Terms: The following table is provided for clarification only:

Similar Terms		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

- C. AABC: Associated Air Balance Council.
- D. NEBB: National Environmental Balancing Bureau.

- E. TAB: Testing, adjusting, and balancing.
- F. TAB Organization: Body governing practices of TAB Specialists.
- G. TAB Specialist: An entity engaged to perform TAB Work.

1.05 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.

1.06 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
 - 1. Provide list of similar projects completed by proposed TAB field supervisor.
 - 2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.
- C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
 - 1. Submit examinations report with qualifications data.
- D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.
- F. Certified TAB reports.

1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 1. Instrument type and make.
 2. Serial number.
 3. Application.
 4. Dates of use.
 5. Dates of calibration.
 - a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.07 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.08 QUALITY ASSURANCE

- A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.
 1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.
- B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:
 1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.
 - a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.
 2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.
 - a. TAB technician shall have minimum 4 years TAB field experience.

- C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.
- D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.
- E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.
 - 1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.
- F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.
- G. TAB Standard:
 - 1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:
 - a. AABC National Standards for Total System Balance, or
 - b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - 2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
 - 3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.
- H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect offices of Capital.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.

2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.
- I. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.
- K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- L. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- M. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.09 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.10 WARRANTY

- A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:
 1. AABC Performance Guarantee.
 2. NEBB Quality Assurance Program.
- B. Refer to Division 01 Specifications for additional requirements.

1.11 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- C. Coordinate TAB work with work of other trades.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION**

3.01 EXAMINATION

- A. Contract Documents Examination Report:
1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:
 - a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
 - b. Proposed corrective action necessary for proper system operation.
 - B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
 - C. Examine the approved submittals for HVAC systems and equipment.
 - D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
 - E. Examine equipment performance data including fan and pump curves.
 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
 - G. Examine test reports specified in individual system and equipment Sections.
 - H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
 - I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
 - J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

- K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report conditions requiring correction discovered before and during performance of TAB procedures.
- P. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02

PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:
 - 1. General description of each air system and sequence(s) of operation.
 - 2. Complete list of measurements to be performed.
 - 3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
 - 4. Qualifications of personnel assigned to Project.
 - 5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc).
 - 6. Table indicating pressure relationships (positive, negative, or neutral) between building spaces.
 - 7. Air terminal correction factors for the following:
 - a. Air terminal configuration.
 - b. Flow direction (supply or return/exhaust).
 - c. Effective area of each size and type of air terminal.
 - d. Air density.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03

GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation." Section 23 80 00 Heating, Ventilating, and Air Conditioning."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04

GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.
- C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.
 1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
 2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.

- D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.
- E. For variable-air-volume systems, develop a plan to simulate diversity.
- F. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- G. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- I. Verify that motor starters are equipped with properly sized thermal protection.
- J. Check dampers for proper position to achieve desired airflow path.
- K. Check for airflow blockages.
- L. Check condensate drains for proper connections and functioning.
- M. Check for proper sealing of air-handling-unit components.
- N. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts." Section 23 80 00 "Heating, Ventilating, and Air Conditioning."
- O. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.
- P. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.05

PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.
 - 2. Measure fan static pressures as follows to determine actual static pressure:

- a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.
 - C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.
 - D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.

- a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- E. Measure air outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.
- F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.
- G. Do not overpressurize ducts.

3.06 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter manufacturer's name, model number, size, type, and thermal-protection-element rating.
 - a. Starter strip heater size, type, and rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the condition of filters.
 - 4. Check the condition of coils.
 - 5. Check the operation of the drain pan and condensate-drain trap.
 - 6. Check bearings and other lubricated parts for proper lubrication.
 - 7. Report on the operating condition of the equipment and the results of the measurements taken. Report conditions requiring correction.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Conditions requiring correction noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.

3.08 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: 10.

2. Air Outlets and Inlets: 10.
3. Multiple outlets within single room: 10 for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for "Air Outlets and Inlets".

3.09 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
 2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
 3. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 1. Title page.
 2. Name and address of the TAB specialist.

3. Project name.
4. Project location.
5. Project Performance Guaranty
6. Architect's name and address.
7. Engineer's name and address.
8. Contractor's name and address.
9. Report date.
10. Signature of TAB supervisor who certifies the report.
11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
13. Nomenclature sheets for each item of equipment.
14. Data for terminal units, including manufacturer's name, type, size, and fittings.
15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.
- F. Test Reports – General:

1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.
- G. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Relief airflow in cfm.
 - l. Outdoor-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
 - m. Return-air damper position.
 - n. Relief-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
 - o. Vortex damper position.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- J. Air-Terminal-Device Reports:
 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.

- d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- K. Instrument Calibration Reports:
1. Report Data:
- a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 INSPECTIONS

- A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
 2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
 3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total

measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
 3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.
- D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 80 00
HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fans.
2. Air inlets and outlets.
3. Dampers.
4. Ductwork.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 23 00 50, Basic HVAC Materials and Methods.
- C. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.
- D. Section 23 09 23, Energy Management Control System.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings:

1. Variable Refrigerant Flow System Conference: Installing contractor's foreman shall attend conference at Project site with design Engineer and equipment manufacturer's representative, to comply with requirements of this Section and manufacturer's installation requirements including but not limited to, the following:
 - a. Proposed deviations from system as shown and described in Contract Documents, including location of system components and impacts to refrigerant pipe sizing.
 - 1) Provide Coordinated Layouts as required by this Section for use in discussion.
 - b. Refrigerant piping assembly practices.
 - c. General discussion, question and answer period.
 - d. Walk site with equipment manufacturer's representative to identify conditions affecting installation of system as designed.

1.04 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.
 - 1. Upon approval of submittal, provide manufacturer's installation and operating instructions to the Project inspector for the following:
 - a. Fire dampers, smoke dampers, and combination smoke-fire dampers.
 - b. Type 1 kitchen exhaust field applied grease duct enclosures.
- C. VRF Systems: Submit system documentation for a fully engineered system, including shop drawings, and wiring and control diagrams, showing location of required manufactured system components, component model numbers and capacities, and size and location of all field-installed components, including piping, required seismic and thermal expansion loops, and wiring. Identify proposed deviations from system as shown in Contract Documents.
- D. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.05 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.
- C. Economizer Fault Detection and Diagnostics (FDD) System Data: For all air-cooled unitary direct-expansion units equipped with an economizer, provide data for third-party supplied California Energy Commission certified FDD controller, documenting

compliance with the requirements of California Building Energy Efficiency Standards. Provide evidence of certification.

- D. Record of pre-installation meeting.
- E. Training Certificates of Completion: Submit certificate from equipment manufacturer, indicating attendance and successful completion of manufacturer's training program for variable refrigerant flow systems installation and service. Training shall include manufacturer's preferred methods for assembling and insulating refrigerant piping and accessories.
- F. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.06 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.
- C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.
 - 2. Provide one complete set(s) of MERV-13 filters for each 4" filter bank.

1.08 COORDINATED LAYOUT

- A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.
- B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.

1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
 2. Show on drawings the intended elevation of all ductwork in accordance with the following example:
 - a. B.O.D. = 9'-0"
 - 1) OFFSET UP 6"
 - 2) B.O.D. = 9'-6"
 3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.
- C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.
- D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.09 QUALITY ASSURANCE

A. Design Criteria:

1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
 2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
 3. All items of a given type shall be products of the same manufacturer.
 4. Scheduled equipment performance is minimum capacity required.
 5. Scheduled electrical capacity shall be considered as maximum available.
- B. Pump types and sizes regulated by the US Department of Energy's "Energy Conservation Standards for Pumps" 10 CRF Parts 429 and 431 shall be marked with a compliant PEICL or PEIVL (Pump Energy Index, constant or variable load) value, basic model number, and RPM on the nameplate. Regulated pumps shall be listed in the Hydraulic Institute (HI) Energy Rating database (er.pumps.org) and be assigned an Energy Rating as defined in the HI 40.5 program guide.

C. Variable Refrigerant Flow Split-System Heat Pump Installer Training: Installing contractor shall have completed training in installation and service of VRF system, by equipment manufacturer.

1. Installing contractor shall obtain, at his own cost, equipment manufacturer's VRF system service tool, unless service tool is normally resident on controller specified for this Project.

1.10 FIELD CONDITIONS

A. Interruption of Existing Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of services.
2. Do not interrupt services without Architect's written permission.

1.11 WARRANTY

A. Air Conditioning Unit, Roof-Mounted:

1. Compressor shall have a five-year warranty.
2. Standard heat exchanger shall have a ten-year warranty.

B. Heat Pump Unit, Roof-Mounted: Compressor shall have a five-year warranty.

C. Heating and Ventilating Unit: Heat exchanger shall have minimum 10-year warranty.

D. High Efficiency Furnace Unit:

1. Heat exchangers shall have a 20-year warranty.
2. Entire unit shall have a 5-year warranty.

E. Air Cooled Condensing Unit: Unit shall have 5-year limited compressor warranty.

1.12 REFERENCE STANDARDS

A. ANSI Z21.47 - American National Standard for Gas-Fired Central Furnaces; 2021.

B. ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2010.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

D. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges; 2021.

E. ASME B31.1 - Power Piping; 2022.

F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

- G. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- H. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- J. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.
- K. ISO 9001 - Quality Management Systems — Requirements; 2015.
- L. MSS SP-67 - Butterfly Valves; 2022.
- M. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
- N. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
- O. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
- P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
- Q. NFPA 17A - Standard for Wet Chemical Extinguishing Systems; 2013.
- R. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- S. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- T. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
- U. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.
- V. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- W. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.
- X. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

- Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- Z. UL 1046 - Standard for Grease Filters for Exhaust Ducts; Current Edition, Including All Revisions.
- AA. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.
- BB. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.02 FANS

- A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.
- B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.
- C. Provide variable speed switch for all direct drive fans.
- D. Roof Mounted:
 - 1. Direct or V-belt Drive: Provide one-piece heavy-duty ventilator housings, one piece heavy gauge spun aluminum construction, with weatherproof assembly and integral weather shield. Mount ventilators on curbs furnished by the fan manufacturer. Install with fan assembly level.
 - 2. Fan wheels shall be centrifugal design, statically and dynamically balanced. Tip speed, rpm and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.
 - 3. Fans shall have integral factory formed base and one piece spinning without welding. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have capacity, speeds and motor sizes as shown.
 - 4. Provide the following accessories:
 - a. Gravity backdraft dampers.
 - b. Aluminum bird screen with a minimum of 85 percent free area.
 - c. Adjustable motor pulley.
 - d. Laboratory fume hood exhaust fans shall be Keysite coated.
 - e. Provide grease collection tray for kitchen exhaust fans.

- f. Provide ventilated roof curb for kitchen exhaust fans where exhaust duct is mounted within rated shaft.
 - g. Provide hinge kit for kitchen hood exhaust fans.
- E. Fan Drives:
- 1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
 - 2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.
 - 3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.
- F. Motors:
- 1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.
 - 2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.
- G. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.
- H. Belts:
- 1. All belts shall be furnished in matched sets.
 - 2. Belts shall be within 1 degree 30 minutes of true alignment in all cases.
- I. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
- 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
- J. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.03

AIR INLETS AND OUTLETS

- A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

- B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.
- C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.04

DAMPERS

- A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.
- B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.
 - 1. Rectangular Ductwork:
 - a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
 - b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
 - c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.
 - 2. Round Ductwork:
 - a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.
 - b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.
 - 3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.
- C. Where required to suit the size of damper required, provide manufacturers standard UL Classified mullions, arranged to support multiple dampers. Assembly shall be of minimum 16 gauge galvanized steel, complete with all accessory caps and framing members required for installation.

2.05 DUCTWORK

- A. Construct and install sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.
1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.
 2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.
 3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.
 4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.
 5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.
 - a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.
 - b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide continuous metal clip at top and sides of duct, with 1 inch overhang for top side.
- B. Design and installation standards:
1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.
 2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
 3. California Mechanical Code.
- C. Duct sizes indicated are external sizes.
- D. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

1. Provide mill certification for galvanized material at request of the Project Inspector.
- E. Duct Sealants:
1. Sealant shall have a VOC content of 250 g/L or less.
 2. [Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
 3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) Design Polymerics, model DP1010.
 - 2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.
 - 3) McGill Airseal, LLC.
- F. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.
- G. Rectangular Duct Fabrication:
1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.
 - a. SMACNA HVAC Duct Construction Standards
 - b. California Mechanical Code
 2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

Duct Dimension	Minimum Gauge	Joint Reinforcement Per CMC
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2
Over 96"	18	K/2

3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.
 4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph "DAMPERS" for damper requirements.
 5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
 6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.
- H. Round and Oval Ductwork Fabrication:

1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.
 - a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.
 - 1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.
 - 2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.
2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; 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.
3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam

24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.
5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
 7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.
- I. Duct Access Doors:
1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door 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 doors. Minimum size access doors shall be 6 inches by 6 inches.
 2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.
- J. Flexible Air Ducts:
1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - 1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.
 - 2) ThermaFlex model M KC.
 2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a

label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.

3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.
 4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.
- K. Flexible Connectors:
1. Materials: Flame-retardant or noncombustible fabrics. Coatings and adhesives shall comply with UL 181, Class 1, with flame spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Metal-Edged Connectors: Factory fabricated with a fabric strip 3 inches wide attached to two strips of 3-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
 3. Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - a. Minimum Weight: 26 oz./sq. yd.
 - b. Tensile Strength: Minimum 475 lbf/inch in the warp and minimum 375 lbf/inch in the filling.
 - c. Service Temperature: Minus 50 to plus 200 deg F.
 4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Ductmate Industries, Inc., model Proflex.
 - b. Ventfabrics, Inc., model Ventlon.

PART 3 EXECUTION

3.01 ROOF MOUNTED EQUIPMENT INSTALLATION

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.
- B. Examine rough-in for roof mounted equipment to verify actual locations of piping and duct connections prior to final equipment installation.
- C. Verify that piping to be installed adjacent to roof mounted equipment allows service and maintenance.
- D. Install ducts to termination at top of roof curb and install heavy duty rubber gaskets on supply and return openings and on full perimeter of curb, or as required for an airtight installation, prior to setting unit on curb.

- E. Cover roof inside each roof mounted air conditioning unit, heat pump unit, and heating and ventilating unit roof curb with 2 inch thick, 3 pound density fiberglass insulation board.
- F. Connect supply and return air ducts to horizontal discharge roof mounted equipment with flexible duct connectors. Provide G 90 galvanized steel weather hood over flexible connections exposed to the weather. Weather hood minimum gauge shall be per PART 2 article, Ductwork, Table A.
- G. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3.02

FAN INSTALLATION

- A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.
- B. Provide access doors for fans or motors mounted in ductwork.
- C. Mount all fans as detailed on Drawings and in compliance with CBC standards.
- D. Fan motors mounted in air-stream to be totally enclosed.
- E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.
- F. Roof fans shall be mounted level.
- G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.
- H. Label fume hood fans with sign "CAUTION - HAZARDOUS EXHAUST."

3.03

AIR INLETS AND OUTLETS INSTALLATION

- A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
- B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.

- C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
 - 1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
 - 2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
 - 3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.
- D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.
- E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.04 TEMPORARY FILTERS

- A. Provide temporary filters for fans that are operated during construction; after construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.
 - 1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.05 DAMPER INSTALLATION

- A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.
- B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.
- C. Install fusible link fire dampers full size of duct at points where shown or required.

- D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.
1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.06 DUCTWORK INSTALLATION

A. General:

1. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight 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. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.
2. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealers shall be fire retardant. Sheet metal screws for joints shall be minimum #10 size galvanized.
3. Where ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
4. Horizontal runs of ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
5. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.
6. Paint inside of ducts, visible through grille, dull black.
7. Where ductwork is installed in finished areas of buildings that do not have ceilings, paint ductwork, support hangers, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.
8. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.

B. Flashing:

1. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
2. Refer to Division 07 specifications and Drawings details as applicable.
3. Flashing for penetrations of roof for mechanical items such as flues and ducts shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.
- C. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

- D. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

- E. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
- F. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.
- 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," hangers and supports sections. Where special hanging of ductwork 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.

1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.
 2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.
- I. Installation of Flexible Ductwork:
1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.
 - a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).
 - b. Flexible duct bends shall be not less than 1-1/2 duct diameter bend radius.
 2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.
 3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

3.07 DUCTWORK SEALING AND LEAK TESTING

- A. All ductwork shall receive a Class A seal.
- B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.
- C. Leakage Classes:

Pressure Class	Leakage Class	
	Round Duct	Rectangular Duct
2"W.G. or less	8	16
4"W.G. or greater	2	4

- D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 23 08 00.13, "Title 24 Commissioning of HVAC."

3.08 HANGER AND SUPPORT INSTALLATION

- A. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Where building structural members do not match piping and ductwork support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.
1. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - a. Provide copper-plated or felt-lined hangers for use on uninsulated copper tubing.
 2. Materials and design for ductwork support shall be per SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
- B. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
- C. Riser clamps: B-line model B3373, or equal.
- D. Rubber Neoprene Pipe Isolators:
1. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.
 2. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
 3. Manufacturers:
 - a. Vertical runs: Acousto-Plumb or equal.
 - b. Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
- E. Pipe Hanger and Support Placement and Spacing:
1. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
 2. Vertical piping hanger and support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Copper Brazed or Soldered (Notes 3, 4)	CPVC & PVC (Note 2)
1/2 - 1"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- a. Note 1: Provide mid-story guides.
 - b. Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - c. Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
 - d. Note 4: Includes refrigerant piping, including vapor and hot gas pipes.
3. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	4 ft.

- a. Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - b. Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
 - c. Note 3: Includes refrigerant piping, including vapor and hot gas pipes.
4. Suspended Piping:
- a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

- b. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.
 - c. Trapeze Suspension: B-Line, or equal, 1-5/8 inch width channel in accordance with manufacturers' published load ratings. No deflection to exceed 1/180 of a span.
 - d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
 - e. Pipe Clamps and Straps: B-Line B2000, B2400, or equal. Where used for seismic support systems, provide B-Line B2400 series, or equal, pipe straps.
 - f. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
 - g. Steel Connectors: Beam clamps with retainers.
5. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
6. Insulated Piping:
- a. Do not interrupt insulation at pipe hangers and clamps.
 - b. Use thermal hanger shield inserts or MSS protection saddles and shields.
 - c. Thermal Hanger Shield Inserts:
 - 1) Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 2) Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 3) For below ambient services, maintain continuous vapor barrier.
 - 4) For Clevis or Band Hangers: Install thermal-hanger shield inserts with insulation protection shields.
 - 5) For Trapeze or Clamped Systems: Install thermal-hanger shield inserts with heavy-duty insulation protection shields. Install additional 180-degree galvanized shield for top of support if clamping is required.
 - d. MSS Protection Saddles and Shields:
 - 1) MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- 2) MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
- 3) Shield Dimensions for Pipe: Of length recommended in writing by manufacturer to prevent crushing insulation. Not less than the following:
 - (a) NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - (b) NPS 4: 12 inches long and 0.06 inch thick.
 - (c) NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - (d) NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - (e) NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

F. Piping Support to Structure:

- 1. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.
 - a. Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062--MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

- b. Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
 - c. Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.
 - 2. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.

G. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

H. Duct Support to Structure:

- 1. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

2. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

3. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.
4. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

3.09

EQUIPMENT START-UP

- A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.
- B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.
- C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.
- D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.
- E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.10

TESTING AND BALANCING

- A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.11 CLEANING AND PROTECTION

- A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.
- B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.]
- C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.
- D. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.12 EQUIPMENT MOUNTING

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

END OF SECTION

SECTION 26 00 10
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

<u>SECTION NO.</u>	<u>SECTION TITLE</u>
260010	BASIC ELECTRICAL REQUIREMENTS
260090	ELECTRICAL DEMOLITION
260519	BUILDING WIRE AND CABLE
260526	GROUNDING AND BONDING
260529	ELECTRICAL HANGERS AND SUPPORTS
260531	CONDUIT
260533	BOXES
260553	ELECTRICAL IDENTIFICATION
260942	DIGITAL LIGHTING CONTROL
262413	SWITCHBOARDS
262726	WIRING DEVICES
262816	OVERCURRENT PROTECTIVE DEVICES
262819	DISCONNECT SWITCHES
264313	SURGE PROTECTIVE DEVICES
265000	LIGHTING

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.

1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Project management and coordination services.
8. Contract modification pricing procedures.
9. Excavation.
10. Rough-in.
11. Electrical installation.
12. Cutting, patching, painting, and sealing.

13. Field quality control.
 14. Cleaning.
 15. Project closeout.
 16. Interface/Responsibility Matrix.
- C. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.
1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
 2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.
 3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.
 4. Concrete work: Include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.
 5. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, luminaires, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
 6. Miscellaneous lumber and framing work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
 7. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. Refer to Division 07, Thermal and Moisture Protection.
 8. Access panels and doors: Required in walls, ceilings, and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.
 9. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.
 10. Luminaire supports: Provide slack support wire for luminaires installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.

- D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:
 - 1. Package mechanical equipment: fans, fan coil units, pumps, boilers, compressors, etc.
 - 2. Kitchen equipment and appliances.
 - 3. Electric signage.
 - 4. Projection screens.
- E. Items furnished under another Division, but installed and connected under this Division
 - 1. Speed control switches for ceiling exhaust fans.

1.02 QUALITY ASSURANCE

- A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.
- B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements, or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.
- C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
 - 1. California Electric Code (CEC).
 - 2. California Building Code (CBC).
 - 3. California Fire Code (CFC).
 - 4. California Mechanical Code (CMC).
- D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories
- E. Independent Testing Agency qualifications:

1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
 2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
 3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
 4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
 5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.
 6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.
- F. All base material shall be ASTM and/or ANSI standards.
- G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the CEC and bear the UL label where such label is applicable.
- H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.03 DEFINITION OF TERMS

- A. The following list of terms as used in the Division 26 documents shall be defined as follows:
1. "Provide": Shall mean furnish, install, and connect unless otherwise indicated.
 2. "Furnish": Shall mean purchase and deliver to Project site.
 3. "Install": Shall mean to physically install the items in-place.
 4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
 5. "As directed": Shall be as directed by the Owner or their authorized Representative.
 6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.04 SUBMITTALS

- A. Format: Furnish submittal data in electronic format for each Specification Section with a table of contents listing materials by Section and paragraph number.
- B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.

- C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents or provide a Specification Section line-by-line compliance response statement with detailed exception/ deviation response statements for all applicable provisions for the applicable Specification Section. Any Specification Section lines without a detailed exception/ deviation response statement shall be treated as the Contractor or Vendor is submitting in full compliance with the applicable Specification Section requirements. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.
- D. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.
- E. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in conformance with the 2019 California Building Code (CBC) and ASCE 7-16. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use $I_p=1.5$. Structural Calculations shall be prepared, stamped, and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.
- F. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights, and approximate centers of gravity.
- G. Review of submittals is for general conformance to design concept and general compliance with the Specification Sections. Submittal Review Comments do not imply waiver of Specifications Section requirements unless specifically noted.
- H. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.
- I. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD)building information modeling (Revit) system for submission by the Contractor. The Engineer can provide CADRevit files of the electrical Contract Documents to the Contractor.
 - 1. Manufactured wiring system, Section 260519.
 - 2. Fire alarm system, Section 266113.
 - 3. Security system, Section 266513.
 - 4. Telecommunication cabling system, Section 267113.
- J. Independent Testing Agency report:

1. Testing Agency shall provide 3 copies of the complete testing report.
 2. Test report shall include the following:
 - a. Summary of Project.
 - b. Description of equipment.
 - c. Equipment used to conduct the test.
 - 1) Type.
 - 2) Manufacturer.
 - 3) Model number.
 - 4) Serial number.
 - 5) Date of last calibration.
 - 6) Documentation of calibration leading to NIST standards.
 - d. Description of test.
 - e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
 - f. Conclusion and recommendation.
 - g. Signature of responsible test organization authority.
 3. Furnish completed test report to Engineer no later than 30-days after completion of testing, unless otherwise directed.
- K. Substitutions:
1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
 2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
 3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility, and appearance. Materials, processes, or equipment, which in the opinion of the Engineer is equal in quality, utility, and appearance, will be approved as substitutions to that specified.
 4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.

5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.
6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes, and equipment, including the effect of the substitution on the Contractor, Subcontractor's, or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.05 COORDINATION

A. Discrepancies:

1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:

1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities, and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.
3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within

reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:

1. Drawings:

- a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.
- b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

D. Utility company contacts:

1. Contact for electrical service:
2. Contact for telephone service:
3. Contact for television service:

1.06 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:

1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit, and wire sizing as well as routing, revised luminaire schedule listing Manufacturers and products installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current, monthly payments may be withheld.
2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD)building information modeling (Revit) process. A set of Revit files of the electrical construction documents will be provided to the Contractor by the Engineer. For the BIM/clash detection process, a Revit file of the electrical construction documents will be provided to the Contractor by the Engineer, which will represent a LOD of 300 design level. The Contractor is responsible for updating the model with changes as well as taking the model to a LOD of 500 design level.
3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
 - a. All underground installation.
 - b. Building electrical rough-in.
 - c. Final electrical installation.
4. Include in the record drawing submission the following shop drawing submission with all updated installation information:
 - a. Manufactured wiring system.

5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
 - a. Two sets of full-size prints.
 - b. Four sets of half-size prints.
 - c. One set of full size reproducibles.
 - d. Electronic files of Drawings in PDF and CADRevit.
- B. Panel schedules:
1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 262416: Panelboards for requirements.
 2. A single set of the record panel schedules shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
 - a. Fold and insert one copy of the appropriate schedule in the pocket of the inner door of each panelboard.
 - b. Three binders, each containing a full set of the panel schedules. Provide index listing all schedules and dividers for separation of schedules as follows:
 - 1) 277/480V normal.
 - 2) 277/480V emergency.
 - 3) 277/480V legally required standby.
 - 4) 277/480V optional standby.
 - 5) 277/480V critical.
 - 6) 277/480V life safety.
 - 7) 277/480V equipment.
 - 8) 277/480V generator equipment.
 - 9) 120/208V normal.
 - 10) 120/208V emergency.
 - 11) 120/208V legally required standby.
 - 12) 120/208V optional standby.
 - 13) 120/208V critical.
 - 14) 120/208V life safety.
 - 15) 120/208V equipment.
 - 16) 120/208V generator equipment.
- C. Field labels, markings, and warning signs: Provide in accordance and as required by:

1. General: CEC Article 110.21.
2. High-Leg System: CEC Article 110.15.
3. Arc-Flash Warning: CEC Article 110.16.
4. Identification of Disconnecting Means: CEC Article 110.22 (A).
5. Engineered Series Combination Systems: CEC Article 110.22 (B).
6. Tested Series Combination Systems: CEC Article 110.22 (C).
7. Available Fault Current: CEC Article 110.24.
8. Depth of Working Space in Existing Buildings: CEC Article 110.26 (A)(1)(c).
9. Guarding of Live Parts: CEC Article 110.27 (C).
10. Locked Rooms or Enclosures: CEC Article 110.34 (C).
11. Manholes: CEC Article 110.75 (E).

1.07 OPERATION AND MAINTENANCE MANUALS

- A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

1.08 PROJECT MANAGEMENT AND COORDINATION SERVICES

- A. Overview: Contractor shall provide a Project Manager/Engineer for the duration of the Project to coordinate the Division 26 Work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this Section.
- B. Review of Shop Drawings prepared by other Subcontractors:
 1. Obtain copies of all Shop Drawings for equipment provided by others that require electrical service connections or interface with Division 26 Work.
 2. Perform a thorough review of the Shop Drawings to confirm compliance with the service requirements contained in the Division 26 Contract Documents. Document any discrepancy or deviation as follows:
 - a. Prepare memo summarizing the discrepancy.
 - b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
 3. Prepare and maintain a shop drawing review log indicating the following information:
 - a. Shop drawing number and brief description of the system/material.
 - b. Date of your review.
 - c. Indication if follow-up coordination is required.
- C. Request for information (RFI):

1. Thoroughly review the Contract Documents prior to the preparation and submission of an RFI. If an RFI is submitted, attach 8 1/2" x 11" copies of all relevant documents to clarify the issue.
 2. Prepare and maintain an RFI log indicating the following information:
 - a. RFI number and brief summary of the issue.
 - b. Date of issuance and receipt of response.
- D. Clarification confirmation memo (CCM):
1. Either the Contractor will prepare CCM memos or the Engineer to confirm a decision clarifying the Contract Documents that does not impact cost or affect other trades.
 2. Prepare and maintain a CCM log indicating the following information:
 - a. CCM number: Use CCM-C1, C2, etc. for memos issued by the Contractor and CCM-E1, E2, etc. for memos issued by the Engineer.
 - b. Brief summary of issue and date issued.

1.09 CONTRACT PRICING MODIFICATION PROCEDURES

- A. Submission guidelines: This Section covers the criteria for direct costs, mark-ups, and documentation requirements to be followed by the Contractor for any pricing modification to the Base Contract, where unit pricing has not already been established.
1. Change orders: Pricing for additions or deletions to the Base Contract Scope of Work upon acceptance of bid value and receipt of authorization to proceed.
 2. Allowances: Cost allowances may be assigned for specific Scope of Work outlined within the Base Contract where design has not been fully delineated on the Contract Documents. When detailed information is available, the Contractor shall prepare and submit a price quotation for the Work. This price quotation will be compared to the allowance value and any adjustments necessary to the Base Contract value shall be made via change order.
- B. Direct costs:
1. Labor:
 - a. Hourly labor rates shall not exceed the prevailing wage for the County where the Work is being performed. The costs for all supervision, including general superintendents and foremen, shall be included in the mark-up defined herein. Working foremen will be considered a direct cost only if the individual is on the Project site physically installing Work under the change order.
 - b. Labor burden shall be based on rates currently in effect at the time the Work under the change order is being performed and shall include only fringe benefits by governing trade organizations, Federal Insurance Contribution Act, Federal and State Unemployment taxes, payroll taxes and net actual premium paid for public liability, workers' compensation, property damage and other forms of insurance required by the Owner. No other cost will be included as labor burden.
 - c. NECA Manual of Labor Units will be utilized as the basis for determining labor productivity rates for Electrical Work as follows:

- 1) 85% of NECA column 1 (normal) for change in scope issued well in advance of Work needing to be performed, so as not to cause slow-down or Work stoppage.
 - 2) 100% of NECA column 1 (normal) for Work being performed with other Base Contract Work, not out of sequence and with minimal slow-down or Work stoppage.
 - 3) 100% of NECA column 2 (difficult) for Work performed out of sequence, requiring Work stoppage and reconstruction in areas already complete. This Work may involve the removal of ceiling tiles or the cutting and patching of walls.
- d. No labor costs shall be included for the following items since the labor is already covered by the NECA labor units for conduit and construction channel:
- 1) Conduit straps and clips.
 - 2) Construction channel accessories (nuts, washers, etc.).
 - 3) Screws.
 - 4) Conduit elbows $\frac{3}{4}$ " and smaller.
2. Material:
- a. The cost of material shall be the direct cost, including sales tax and may include the cost of transportation from the Supplier to the Contractor, but charges for final delivery to the Project site will not be allowed.
 - b. Electrical commodities priced based on most current Trade Service Book with a 15% discount. Non-commodities priced per invoice from Supplier.
3. Equipment rental:
- a. Payment for equipment costs will be made at the rental rates listed for such equipment as specified in the current edition, at the time of the Work, of "Labor Surcharge and Equipment Rental Rates," a Caltrans Publication. Such rental rates shall be adjusted as appropriate and will be used to compute payments for equipment; regardless of the whether the equipment is under Contractor's control through direct ownership, leasing, renting or other method of acquisition. Daily, weekly, or monthly rates shall be used, whichever is lower. Hourly rates including operator shall not be used.
 - b. The actual time to be paid for equipment shall be the time the equipment is in productive operation on the Work. No payment will be made time while equipment is inoperative due to breakdown or for non-working days.
 - c. Individual pieces of equipment having a replacement value of \$1,000 or less shall be considered small tools or small equipment and no payment will be made since the costs of these tools and equipment are included as part of the Contractor's mark-up for overhead and profit.
 - d. Payment to Contractor for use of equipment as set forth herein shall constitute full compensation to Contractor for the cost of fuel, power, oil, lubricants, supplies,

small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators) and any and all costs to Contractor for incidental use of the equipment.

4. Performance bond: Only the actual cost of insurance and bond premiums, with no mark-up for overhead and profit, will be allowed.
- C. Mark-up for overhead and profit on direct costs:
1. Costs to be included as part of mark-up:
 - a. Field and home office personnel including, but not limited to, Principals, Project Managers, Superintendents, Supervisory Foremen, Estimators, Project Engineers, Detailers, Draftspersons, Schedulers and Administrative Assistants.
 - b. All field and home office expenses including, but not limited to, field trailers, parking, storage sheds, office equipment and supplies, telephone service at the Project site, long-distance telephone calls, fax machines, computers and software, temporary utilities, sanitary facilities, etc.
 - c. Administrative functions including, but not limited to, reviewing, coordinating, distributing, processing, posting, recording, estimating, negotiating, scheduling, schedule updating and revising, expediting, detailing, revising Shop Drawings and preparing Record Drawings.
 - d. Vehicles required for the transportation of Contractor's staff and field personnel.
 2. Maximum mark-up values:
 - a. For Work performed by the Contractor, the overhead mark-up shall equal a maximum of 10 percent of the direct costs, as defined herein.
 - b. Mark-up for profit shall equal a maximum of 5 percent of combined direct and overhead costs.
 - c. For Work performed by a Subcontractor shall equal a maximum of 5 percent mark-up for profit. Subcontractor shall follow the same guidelines above for their mark-up allowance. No consideration shall be given for more mark-ups then this two-tier arrangement whereas the mark-up could excess 20%.
 - d. For Work scope changes that result in a net decrease in cost to the Contractor or a Subcontractor, the Owner shall receive a credit based on the actual net decrease in direct cost figured in the same manner as an add cost. It is understood that the mark-up value applied at bid time will not be credited back. Although, if this is a change to a previous change order, then mark-up values shall be included in credit back to Owner.
 - e. There will be no mark-ups on the cost of performance bond.
- D. Documentation:
1. Project change order request submission:
 - a. Provide copies of all take-off sheets showing material and labor charges in line item format.
 - b. Provide recap sheet showing all direct costs and mark-ups.

- c. Provide copies of invoices for Subcontracted Work.
2. Allowance account tracking:
 - a. Contractor shall prepare and maintain a spreadsheet for each allowance account to track and monitor the requested and approved charges.
 - b. Copies of these spreadsheets, along with the summary spreadsheets, shall be submitted to the Owner's Representative twice a month.

PART 2 - PRODUCTS (NOT APPLICABLE)**PART 3 - EXECUTION****3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION**

- A. All work shall be installed in a neat, workmanlike manner in accordance with ANSI/NECA 1-2015.
- B. Comply with the requirements of all listed codes and standards.
- C. All materials and equipment provided under this contract shall be new (except where otherwise noted) and shall be listed, labeled or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL.
- D. All equipment of the same type and capacity shall be by the same manufacturer.
- E. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.
- F. During construction the contractor shall at all times maintain electrical utilities of the building without interruption. Should it be necessary to interrupt any electrical service or utility, the contractor shall secure permission in writing from the owner's representative for such interruption at least ten (10) business days in advance. Any interruption shall be made with minimum amount of inconvenience and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary power source as required by project conditions.
- G. Working clearance around equipment shall not be less than that specified in the CEC for all voltages specified.
- H. The locations of switches, receptacles, lights, motors, etc. outlets shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with ducts, piping, etc. The contractor shall check all door swings so that light switches are not located behind doors. Relocate switches as required, with approval from the Design Professional. The owner's representative may direct relocation of outlets before installation, up to five (5) feet from the position indicated on the Drawings, without additional cost.
- I. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a

way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.

1. Where the owner's representative determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the owner.
 2. "Conveniently Accessible" is defined as being capable of being reached without climbing or crawling over or under obstacles such as motors, pumps, belt guards, transformers, racks, piping, ductwork, raceways or similar.
- J. Owner furnished equipment: Equipment furnished by the District shall be received, stored, uncrated, protected, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself and shall hold the warranty

3.02 ROUGH-IN

- A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.
- B. Verify final locations for rough ins with field measurements and with the requirements for the actual equipment to be connected.
- C. Refer to equipment specification in Divisions 22 through 33 for rough-in requirements.

3.03 ELECTRICAL INSTALLATION

- A. Preparation, sequencing, handling, and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
 1. Shop Drawings prepared by Manufacturer.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
 7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised

service companies and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Coordinate electrical systems, equipment, and materials installations with other building components.
12. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.
13. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.
14. Conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

3.04 CUTTING, PATCHING, PAINTING AND SEALING

- A. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- C. Cut, remove, and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.
- D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- F. Patch existing surfaces and building components using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.
- G. Application of joint sealers:

1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.05 FIELD QUALITY CONTROL

A. General testing requirements:

1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer's tolerances and is installed in accordance with design Specifications.
2. Tests and inspections shall determine suitability for energization.
3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:

1. Equipment operations: Test motors for correct operation and rotation.
2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.
3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.
4. Circuit numbering verification: Select on a random basis, various circuit breakers within the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.
5. Voltage check:
 - a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
 - b. Adjust taps on transformers to give proper voltage, which is 118 to 122volts for 120volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.

C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.

D. Testing safety and precautions:

1. Safety practices shall include the following requirements:
 - a. Applicable State and Local safety operating procedures.
 - b. OSHA.
 - c. NSC.
 - d. NFPA 70E.
 2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.
- E. Calibration of test equipment:
1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
 2. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: Analog, 6-months maximum; Digital, 12-months maximum.
 - b. Laboratory instruments: 12-months.
 - c. Leased specialty equipment: 12-months where accuracy is guaranteed by lessor.
 3. Dated calibration labels shall be visible on test equipment.
 4. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
 5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
 6. Calibration standards shall be of higher accuracy than instrument tested.
 7. Equipment used for field testing shall be more accurate than instrument being tested.
- F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.
- G. Notify Owner and Engineer one week in advance of any testing.
- H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.
- I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.
- J. Include all test results in the maintenance manuals.
- 3.06 CLEANING
- A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

- B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.07 PROJECT CLOSEOUT

- A. Training:
 - 1. At the time of completion, a period of not less than 4-hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 4-hour training is in addition to any instruction time called out in the Specifications for specific systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer's Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.
 - 2. All training sessions shall be video recorded. Confirm file type, i.e. MOV, AVI, MP4, etc. with the district. Each specification section that requires training shall include one file, and all Division 26 specifications shall be stored on a flash drive (USB3.0, 1TB min.) 3 flash drives shall be provided to the district representative with closeout documentation.
- B. Special tools: Provide one of each tool type required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.
- C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

END OF SECTION

SECTION 26 00 90
ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor and equipment necessary to complete the demolition required for the item specified under this Division, including but not limited to:
 - 1. Electrical demolition

1.02 SYSTEM DESCRIPTION

- A. Disconnection, removal and relocation of all wiring, luminaires, outlets, conduit, and all other types of electrical equipment as described on Drawings.
- B. Purpose is to remove, relocate and extend existing installations to accommodate new construction.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment necessary for patching and extending Work, as specified in other Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly review conditions in the area of demolition prior to commencing Work to ensure complete understanding of existing installation in relationship to demolition Work.

3.02 GENERAL REQUIREMENTS

- A. Remove all wiring, luminaires, outlets, conduit, and all other types of electrical equipment indicated to be removed. Devices that are to be removed may require reworking conduit and wiring in order to maintain service to other devices. If removed devices are on walls or ceilings that are to remain, blank coverplates are to be installed on outlet boxes.
- B. Where remodeling interferes with circuits in areas that are otherwise undisturbed, circuits shall be reworked as required.
- C. Existing devices and circuiting that are indicated are indicated only for informational purposes. Contractor shall visit the Project site and shall verify conditions as they exist and shall remove, relocate, and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all Work with that of other trades.

- D. All equipment, luminaires, devices, etc., which are removed shall be delivered to the Owner for disposition. All items which are removed and not wanted by the Owner and which are not reused shall become the property of the Contractor and shall be legally removed from the Project site.
 - E. Cutting and patching necessary for the removal of Electrical Work shall be included.
 - F. Remove and replace luminaires, rework, relocate or replace conduit and wiring and do other Work required by the installation of new ductwork, piping, etc., above the ceiling. Coordinate with other trades and verify the extent of the Work.
- 3.03 LUMINAIRES
- A. Disconnect and remove abandoned luminaires. Remove conduits, wiring, boxes, brackets, stems, hangers, and other accessories.
- 3.04 OUTLETS
- A. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- 3.05 CONDUIT
- A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.
- 3.06 WIRING
- A. Remove abandoned wiring to source of supply.
- 3.07 EXISTING SYSTEMS
- A. Electrical distribution system: Disable system only to make switchovers and connections. Obtain permission from Owner's designated representative at least 24-hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to Work area.
- 3.08 CLEANING AND REPAIR
- A. Clean and repair existing materials and equipment that shall remain.
 - B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
 - C. Luminaires: Remove lenses and lamps and clean all exposed surfaces. Also clean the lenses or replace if discolored. Provide all new lamping when re-assembling.

END OF SECTION

SECTION 26 05 19
BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Building wire.
 - 2. Cable.
 - 3. Wiring connections and terminations.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 4; Armored Cable.
 - UL 44; Thermoset-Insulated Wires and Cables.
 - UL 62; Flexible Cord and Fixture Wire.
 - UL 83; Thermoplastic-Insulated Wires and Cables.
 - UL 183; Manufactured Wiring Systems.
 - UL 310; Electrical Quick-Connect Terminals.
 - UL 486A & B; Wire Connectors.
 - UL 486C; Splicing Wire Connectors.
 - UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
 - UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
 - UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - UL 1581; Reference Standard for Electrical Wires, Cables and Flexible Cords.
 - UL 2196; Standard for Tests of Fire Resistive Cables.
 - 2. National Electrical Manufacturer Association (NEMA):

NEMA WC-70; Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.

3. Institute of Electrical and Electronic Engineers (IEEE):

IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

IEEE 576; Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 3. Submit Manufacturer's installation instructions.
 4. Final test results.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Building wire:
 - a. Cerrowire
 - b. General Cable
 - c. Southwire Company
 - d. Stabiloy (aluminum only)
 - e. United Wire and Cable
 2. Flexible cords and cables:
 - a. Carol Cable Company

- b. Cerrowire
- c. PWC Corp
- 3. Wiring connectors and terminations:
 - a. 3M Company.
 - b. Ideal.
 - c. Blackburn-Holub.
 - d. Burndy.
 - e. Thomas & Betts Corp.
 - f. Beau Barrier.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 BUILDING WIRE

A. Conductor material:

- 1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
- 2. All building wire shall be stranded, unless otherwise indicated.

B. Insulation material:

- 1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.
- 2. Thermoplastic-insulated building wire.
- 3. Rubber-insulated building wire.
- 4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.
- 5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
- 6. Feeders and branch circuits for direct-current (DC) in wet locations: Type XHHW-2.
- 7. Conductors for variable frequency drives (VFD): Type XHHW-2.
- 8. Service Entrance: Type RHW or THWN.
- 9. Control Circuits: Type THW or dual rated THHN/THWN.
- 10. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.03 FLEXIBLE CORDS AND CABLES (TYPE'S')

- A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.
- B. Type 'S' flexible cords and cables shall be manufactured in accordance with CEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.

- C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as an integral component of the connector or as an independently supported unit.
- D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.04 WIRING CONNECTIONS AND TERMINATIONS

- A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.
- B. Electrical spring wire connectors:
 - 1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
 - 2. Self-striping pigtail and tap U-contact connectors shall not be used.
- C. Compression type terminating lugs:
 - 1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.
 - 2. Two-hole, long barrel lugs shall be provided for size #4/0 and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.
- D. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7-mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000volts suitable for temperatures from minus 18-degrees C to 105-degrees C.
- E. Insulating putty:
 - 1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
 - 2. Use putty suitable for temperatures from minus 17.8-degrees C to 37.8-degrees C with a dielectric strength of 570volts/mil minimum.
- F. Insulating resin:
 - 1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
 - 2. Use resin with a set up time of approximately 30-minutes at 21.1-degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.
- G. Terminal strips:
 - 1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
 - 2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.

3. Identify all terminals with numbering sequence being used for a system.
- H. Crimp type connectors:
1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
 2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
 3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
 4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.
- I. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.
- J. Wire lubricating compound:
1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
 2. Shall not be used on wire for isolated type electrical power systems.
- K. Bolt termination hardware:
1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
 2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
 3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.
 4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
 5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
 - a. 1/4" bolt: 125amps
 - b. 5/16" bolt: 175amps
 - c. 3/8" bolt: 225amps
 - d. 1/2" bolt: 300amps
 - e. 5/8" bolt: 375amps
 - f. 3/4" bolt: 450amps

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

- A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.
- B. Feeders and branch circuits in wet locations shall be rated 75-degree C.
- C. Feeders and branch circuits in dry locations shall be rated 90-degree C.
- D. Feeders and branch circuits for direct-current (DC) systems, such as PV installations, in wet locations shall be type XHHW-2 copper conductors.
- E. For wiring of the following, refer to the indicated Code Articles:
 - 1. Fire pump systems shall comply with CEC Article 695.
 - 2. Emergency systems shall comply with CEC Article 700.
 - 3. Fire alarm systems shall comply with CEC Article 760.
 - 4. Where the any above are required to be fire-resistive, refer to CEC Article 728.
- F. Minimum conductor size:
 - 1. Provide minimum AWG #12 for all power and lighting branch circuits.
 - 2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.
- G. Color coding:
 - 1. For 120/208volt, 3-phase, 4-wire systems:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - e. Ground - Green
 - 2. For 277/480volt, 3-phase, 4-wire systems:
 - a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - d. Neutral - Gray
 - e. Ground - Green
 - 3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.

4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.03 WIRING METHODS

- A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Install all single conductors in raceway system, unless otherwise noted.
- C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.
- D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
- E. 20amp power and lighting branch circuit containing no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208volt circuits located outside a 75-foot radius of panel source and for 277/480volt branch circuits located outside a 200-foot radius of panel source, unless otherwise noted.
- F. 20amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208volt circuits located outside a 65-foot radius of panel source and for 277/480volt circuits located outside a 150-foot radius of panel source.
- G. Provide #10 AWG pig tails on all 20amp and 30amp wiring devices served by #8 AWG conductors and larger.
- H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.
- I. Install cable supports for all vertical feeders in accordance with the CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.
- J. Neatly form, train, and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches, and equipment assemblies.
- K. Seal cable or wire, entering a building from underground or exiting walk-in cold box or freezer, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.
- L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type, and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.
- M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.
- N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.04 WIRING INSTALLATION IN RACEWAYS

- A. Install wire in raceway in accordance with IEEE 576, Manufacturer's written instructions, as indicated on the Drawings and as specified herein after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.
- B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than #1 AWG.
- E. Wire pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use rope made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
 - 4. Pull in together multiple conductors or cables in a single conduit.
 - 5. Pulling tensions and sidewall pressures shall not exceed 60% of the manufacturer's recommended maximum values. Pulling tension shall be continuously monitored during the pull by a calibrated dynamometer. If pulling tension is exceeded during the pull, immediately notify the engineer to determine if the cables will be considered damaged and require contractor replacement.
- F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.05 MC CABLE INSTALLATION

- A. Use of MC Cable is restricted to installation above accessible ceiling space, for lighting installed in the t-bar ceiling. Circuiting shall be routed to each individual room via conduit and wire to distribution junction boxes for conversion from hardwire to MC cable wiring system. Install these boxes such that they are accessible from below.
- B. Install MC cable in accordance with Manufacturer's instructions and in strict accordance with CEC Article 330. Secure and support MC cable with straps, independent hanger wire per CEC 300.11 (B), or cable ties listed for the purpose. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.
- C. Support cables every 6-feet and within 12-inches of boxes, per CEC Article 330, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

- D. Hanger wire used to support suspended ceilings may not be used to directly support MC cables.
- E. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.
- F. Bend the cable per CEC Article 330.
- G. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.06 WIRE SPLICES, JOINTS AND TERMINATION

- A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.
- B. Thoroughly clean wires before installing lugs and connectors.
- C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- D. Splices and terminations shall be made mechanically and electrically secure.
- E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.
- F. Terminate wires in Terminal Cabinets, relay, and contactor panels, etc. using terminal strip connectors.
- G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.
- H. Install cable ties and maintain harnessing.
- I. Encapsulate splices in exterior outlets, pull boxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.
- J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least 6-inches of tail and neatly packed in box after splice is made up.
- K. Branch circuits (#10 AWG and smaller):
 - 1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600volt, 105-degree C. with integral insulation, approved for copper conductors.
 - 2. The integral insulator shall have a skirt to completely cover the stripped wires.
 - 3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.
- L. Feeder circuits: (#6 to 750 kCMIL)
 - 1. Join or tap conductors from #6 AWG to 750 kCMIL using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.

2. Terminate conductors from size #6 AWG to 750 kCMIL copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
 3. Field installed compression connectors for cable sizes 250 kCMIL and larger shall have not less than two clamping elements or compression indents per wire.
 4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
- M. Termination hardware assemblies:
1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
 2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
 3. The crown of Belleville washers shall be under the nut.
 4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendations are not obtainable, the following values shall be used:
 - a. 1/4" - 20 bolt at 80-inch pounds torque.
 - b. 5/16" - 18 bolt at 180-inch pounds torque.
 - c. 3/8" - 16 bolt at 20-foot pounds torque.
 - d. 1/2" - 13 bolt at 40-foot pounds torque.Fp
 - e. 5/8" - 11 bolt at 55-foot pounds torque.
 - f. 3/4" - 10 bolt at 158-foot pounds torque.

3.07 IDENTIFICATION

- A. Refer to Section 260553: Electrical Identification for additional requirements.
- B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.
- C. Color code conductors' size #8 and larger using specified phase color markers and identification tags, with exception of the grounded conductor which must have a continuous white or gray jacket if #6 or smaller.
- D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.
- E. In manholes, pull boxes and handholes, provide tags of the embossed brass type and show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.08 FIELD QUALITY CONTROL

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent

- Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements.
- B. Prefunctional testing:
1. Visual and mechanical inspection:
 - a. Compare cable data with Contract Documents.
 - b. Inspect exposed sections of wires and cables for physical damage and proper connections.
 - c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.
 - d. Inspect compression applied connectors for correct cable match and indentation.
 - e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.
 - f. If cables are terminated through window type current transformers, inspect to verify neutral and ground conductors are correctly placed for operation of protective devices.
 - g. Ensure wire and cable identification has been installed as specified herein.
 2. Electrical testing:
 - a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances. Testing shall be as follows:
 - 1) 100% of all feeders 100amp rated and above.
 - 2) 50% of all feeders smaller than 100amps.
 - 3) 10% of all branch circuits at each individual panelboard.
 - b. Perform insulation-resistance test using megohm meter with applied potential of 1000volt DC for a continuous duration of 60-seconds. Test conductors' phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.
 - c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.
 - d. Contractor shall furnish instruments, materials, and labor for these tests.
 3. Test values: Investigate resistance values less than 50-megohms.
 4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Power system grounding.
 - 2. Site lighting grounding.
 - 3. Electrical equipment and raceway grounding and bonding.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 05: Building Steel.
 - 3. Division 22: Cold Water Piping.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 467; Grounding and Bonding Equipment.
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
 - IEEE No. 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment as described herein and indicated on Drawings.
- B. Ground each separately derived system neutral as described herein and indicated on Drawings.
- C. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, cable trays, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.

D. Resistance:

1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5-OHMS unless otherwise noted.
2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20-OHMS

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Ground Rods:
 - a. Weaver.
 - b. Erico "Cadweld" Products, Inc.
 2. Ground Wells:
 - a. Christy Concrete Products, Inc.
 - b. Forni Corp.
 3. Ground Bushings, Connectors, Jumpers and Bus:
 - a. O-Z/Gedney.
 - b. Thomas & Betts Corp.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GROUND CONDUCTORS

- A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.
- B. General purpose insulated:

1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
 2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.
- C. Bare conductors in direct contact with earth or encased in concrete: #4/0 AWG copper minimum, U.O.N.
- D. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.
- 2.03 DRIVEN (GROUND) RODS
- A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.
- 2.04 GROUND WELL BOXES FOR GROUND RODS
- A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".
- 2.05 INSULATED GROUNDING BUSHINGS
- A. Plated malleable iron or steel body with 150-degree Centigrade molded plastic insulating throat and lay-in grounding lug.
- 2.06 CONNECTIONS TO PIPE
- A. For cable to pipe: UL and CEC approved bolted connection.
- 2.07 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES
- A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high-pressure compression type connectors.
1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
 2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.
- 2.08 EXTRA FLEXIBLE, FLAT BONDING JUMPERS
- A. Where required by Code, indicated on the Drawing, and specified herein.
- 2.09 BUILDING GROUND BUS REQUIREMENTS
- A. Main building power system ground bus:
1. Provide one 24" wide x 4" high x 1/4" thick copper bus bar as a minimum. Mount on wall in main electrical room utilizing insulating stand-offs at 18" above finished floor.

2. Furnish complete with cast copper alloy body lugs for connecting grounding system conductors. Attach lugs to bus with appropriate size cadmium bronze bolt, flat washer, and Belleville washer. Torque all lug connections.
 3. All holes shall be drilled and tapped for single-hole lugs. Provide 6 spare lugs and lug spaces.
- B. Building power system reference ground bus:
1. The reference ground bus is furnished as part of the main electrical switchboard for the building, along with neutral disconnect and bus, and is in addition to the main building power system ground bus outlined above. The building grounding electrode shall make a direct connection to the building referenced ground bus in the main switchboard.
 2. Provide a #4/0 AWG copper ground conductor connection between the building reference ground bus in switchboard and the main building ground bus wall mounted in main electrical room.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. Grounding electrodes:
1. Metal underground water pipe: Cold water metal piping system: Where the underground cold water service line is metal, indirect contact with the earth for 10-feet or more, the Contractor shall install a grounding electrode conductor from the main incoming cold water line ahead of the meter and extend to the main building reference ground bus in the main electrical room. The electrode shall be sized per CEC Article 250. Electrode connection should be accessible.
 2. Concrete encased grounding electrode (UFER ground): Provide a #4/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. The electrode shall extend through a horizontal length of 30 feet minimum and shall be encased in not less than 2 or more than 5 inches of concrete separating it from surrounding soils. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to the main building reference ground bus.
 3. Supplementary grounding electrode (ground ring, grid and driven rods): Provide, as indicated on the Drawings, driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod with structural steel and adjacent rods with minimum #2 AWG bare copper conductor. Ground rod shall not be less than 10 foot from any other electrode of another electrical system or from adjacent ground rod(s).
- B. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.
- C. Power system grounding:

1. Provide, unless otherwise indicated, a main building power system ground bus mounted on the wall in the main electrical room. Connect the following items using CEC sized copper grounding conductors to lugs on the main building ground bus:
 - a. Grounding conductor from building reference ground bus in main service switchboard.
 - b. Bonding conductor to metallic cold-water piping system.
 - c. Bonding conductor to building structural steel.
 - d. Separately derived system grounding conductors in same room.
 2. At the building power system reference ground bus in the main service switchboard, connect the grounding electrode conductor from concrete encased UFER ground or other grounding electrode systems as indicated on the Drawing or herein.
- D. Separately derived electrical system grounding:
1. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.
 2. Transformers: Provide copper terminal bar for grounding and bonding the transformer in accordance with CEC Articles 250.30 and 450.10. Bond the terminal bar to the enclosure and connect the following to the terminal bar:
 - a. Primary feeder equipment ground conductor(s).
 - b. Secondary feeder supply-side bonding jumper(s).
 - c. Grounding electrode conductor.
 - d. Main bonding jumper to neutral (when present).
 - e. Supplemental grounding electrodes.
- E. Equipment bonding/grounding:
1. Provide a CEC sized insulated copper ground conductor in all 120volt AC through 600volt AC feeder and branch circuit distribution conduits and cables.
 2. Provide a separate grounding bus at panelboards, switchboards. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35volts above ground.
 3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
 4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold-water piping system.
 5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.
- F. Site lighting grounding: Bond all metallic light poles and bollards. Provide ground rods where indicated on the Drawings.

3.03 FIELD QUALITY CONTROL

- A. Independent Testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein.
- B. Prefunctional testing:
 - 1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.
 - 2. Visual and mechanical inspection:
 - a. The Testing Agency shall inspect the grounding electrode and connections prior to concrete encasement, burial, or concealment.
 - b. Check tightness and welds of all ground conductor terminations.
 - c. Verify installation complies with the intent of the Contract Documents
 - 3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.
 - 4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION

SECTION 260529
ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Conduit supports.
 - 2. Equipment supports.
 - 3. Fastening hardware.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 03: Cast-in-place concrete. Concrete equipment pads.
 - 3. Division 05: Miscellaneous metals. Hangers for electrical equipment.
 - 4. Division 09: Ceiling suspension systems. Slack support wires.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.03 SYSTEM DESCRIPTION

- A. Provide devices specified in this Section and related Sections for support of electrical equipment furnished and installed under Division 26.
- B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

- 1. Concrete fasteners:
 - a. Phillips "Red-Head".
 - b. Remington.
 - c. Ramset.
- 2. Concrete inserts and construction channel:
 - a. Unistrut Corp.
 - b. GS Metals "Globe Strut."
 - c. Thomas & Betts "Kindorf" Corp.
- 3. Conduit straps:
 - a. O-Z/Gedney.
 - b. Erico "Caddy" Fastening Products.
 - c. Thomas & Betts "Kindorf" Corp.

- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONCRETE FASTENERS

- A. Provide expansion-shield type concrete anchors.
- B. Provide powder driven concrete fasteners with washers. Obtain approval by Architect and Structural Engineer prior to use.

2.03 CONCRETE INSERTS

- A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.04 THREADED ROD

- A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in the Specifications.

2.05 CONSTRUCTION CHANNEL

- A. Provide 1.5-inch by 1.5-inch, 12-gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1-1/2 inch on center in the base of the channel.

2.06 CONDUIT STRAPS

- A. One-hole strap, steel, or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.
 - 1. Use malleable strap with spacers for exterior and wet locations.
 - 2. Use steel strap without spacers for interior locations.
- B. Steel channel conduit strap for support from construction channel.
- C. Steel conduit hanger for pendant support with threaded rod
- D. Steel wire conduit support strap for support from independent #12-gauge hanger wires.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Coordinate size, shape, and location of concrete pads with Division 03, Cast-in-place concrete.
- B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.
- C. Where indicated on the Contract Documents, install freestanding electrical equipment on concrete pads.

3.03 INSTALLATION

- A. Furnish and install supporting devices as noted throughout Division 26.
- B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.
- C. Fasten hanger rods, conduit clamps, outlet, and junction boxes to building structure using precast inserts, expansion anchors, preset inserts, or beam clamps.
- D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.
- E. Use expansion anchors or preset inserts in solid masonry walls.
- F. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.
- G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.
- H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.
- I. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.

- J. Fabricate supports from structural steel or steel channel, rigidly welded, or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- K. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.
- L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.04 ERECTION OF METAL SUPPORTS

- A. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.05 WOOD SUPPORTS

- A. Cut, fit, and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

3.06 ANCHORAGE

- A. All floor mounted, free standing electrical equipment such as transformers, switchboards, distribution boards, etc. shall be securely fastened to the floor structure.
- B. Anchorage of electrical equipment shall comply with the seismic requirements as outlined in Section 260010: Basic Electrical Requirements.

END OF SECTION

SECTION 260531
CONDUIT

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Rigid steel conduit and fittings.
 - 2. PVC insulated rigid steel conduit and fittings.
 - 3. Intermediate metal conduit and fittings.
 - 4. Electrical metallic tubing and fittings.
 - 5. Flexible metallic conduit and fittings.
 - 6. Liquidtight flexible metallic conduit and fittings.
 - 7. Miscellaneous conduit fittings and products.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 01: Cutting and patching.
 - 3. Division 07: Sheet metal flashing and trim.
 - 4. Division 09: Painting. Exposed conduit and other devices.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI):
 - ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
 - ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
 - ANSI C80.5; Rigid Aluminum Conduit.
 - ANSI/ TIA-569-D Telecommunications Pathways and Spaces.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 1; Flexible Metal Conduit.
 - UL 6; Rigid Metal Conduit.
 - UL 360; Liquid-Tight Flexible Steel Conduit.

UL 514B;	Conduit, Tubing and Cable Fittings.
UL 635;	Insulating Bushings.
UL 797;	Electrical Metallic Tubing - Steel.
UL 1242;	Intermediate Metal Conduit - Steel.

3. National Electrical Manufacturer Association (NEMA):

NEMA RN1;	PVC Externally coated Galvanized Rigid Steel Conduit.
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1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools, or specific installation techniques.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Metal conduit:
 - a. Allied Tube and Conduit Co.
 - b. Triangle PWC, Inc.
 - c. Western Tube and Conduit Corp.
 - d. Spring City Electrical Manufacturing Co.
 - e. Alflex Corp.
 - f. American Flexible Metal Conduit Co.
 - g. Anaconda.
2. Fittings:
 - a. Appleton Electric Co.
 - b. OZ/Gedney.

- c. Thomas & Betts Corp.
- d. Spring City Electrical Manufacturing Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GALVANIZED RIGID STEEL CONDUIT (GRS)

- A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
- B. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure; provide two locknuts at each box or can, inside and outside.
- C. Three-piece couplings: Hot dip galvanized, cast malleable iron.
- D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150-degree C minimum.
- E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
- F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150-degrees C.
- G. All fittings and connectors shall be threaded.

2.03 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

- A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
- B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.
- B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.05 ELECTRICAL METALLIC TUBING (EMT)

- A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.
- B. Set screw type couplings: Hot dip galvanized, steel, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case-hardened steel with hex-head and cup point to firmly seat in wall of conduit for positive grounding.

- C. Set screw type connectors: Hot dip galvanized, steel, UL listed concrete tight with male hub and insulated plastic throat, 150-degree C temperature rated. Setscrew shall be same as for couplings.
- D. Raintight couplings: Hot dip galvanized, steel; UL listed raintight and concrete tight, using gland and ring compression type construction.
- E. Raintight connectors: Hot dip galvanized, steel, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.06 FLEXIBLE METALLIC CONDUIT (FMC)

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.
- B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for luminaire connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.
- B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.08 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

- A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.
- B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.
- C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.
- D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate 0.75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless-steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

- E. Fire rated penetration seals:
 - 1. UL building materials directory classified.
 - 2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
 - 3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet, or wrap/strip.
- F. Standard products not herein specified:
 - 1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
 - 2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
 - 3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.
- G. Hazardous area fittings: UL listed for the application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

- A. Galvanized rigid steel conduit (GRS) can be used in the following applications:
 - 1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with CEC and local Codes.
 - 2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.
 - 3. For use where conduit is subject to physical damage.
 - 4. For feeders and branch circuits installed exposed on the roof.
- B. PVC insulated galvanized rigid steel conduit can be used in the following applications:
 - 1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
 - 2. Use 20- or 40-mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
 - 3. Use 20- or 40-mil for runs beneath floor slabs on grade.
 - 4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.

- C. Intermediate metal conduit (IMC): Can be used for the same application as galvanized rigid steel conduit as specified herein, except for hazardous locations prohibited by CEC or Local Codes.
- D. Electrical metallic tubing (EMT): Can be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 8 feet above the finish floor except within electrical, communication or signal rooms or closets (subject to physical damage).
- E. Flexible metallic conduit (FMC): Can be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to luminaires installed in suspended ceilings.
- F. Liquidtight flexible metallic conduit (LFMC): Can be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc.
- G. Fire-Resistive Systems: Refer to CEC Article 728. All devices utilized, mountings, and supports shall be listed as part of the fire-resistive system.

3.03 PREPARATION

- A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
- B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.
- C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.
- D. Conduits shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- E. Communications conduits shall not be placed closer than 12 inches to power, a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- F. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.
- G. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of

concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

- H. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150-feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.
- I. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated, or specified in the Contract Documents or not.
- J. Connect recessed luminaires to conduit runs with maximum six feet of flexible metal conduit.

3.04 INSTALLATION

- A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 3/4" for interior applications and 1" for exterior and underground applications.
- C. Minimum Communication and Signal Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1" for interior applications and 2" for exterior and underground applications.
- D. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.
- E. All communication and signal conduit sizes indicated on the Drawings are sized for 40% fill or less for category 6 or 6A cable. If cable type or size is changed the Contractor shall be responsible for resizing conduits upward to meet a maximum 40% fill.
- F. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.
- G. Conduit connections to motors and surface cabinets shall be concealed, except for electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.
- H. Install conduits in complete runs before pulling in cables or wires.
- I. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.
- J. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.
- K. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.
- L. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

- M. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.
- N. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.
- O. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).
- P. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.
- Q. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360-degrees, total).
- R. A run of communications and signal conduit between terminations at wire pulling points shall not contain more than the equivalent of two quarter bends (180-degrees, total).
- S. Emergency power raceway system: Install entirely independent of other raceway systems, except where specifically allowed by CEC Article 517.

3.05 PENETRATIONS

- A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
 - 1. Where indicated on the Structural Drawings.
 - 2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size, and position of each penetration.
- B. Cutting or holes:
 - 1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
 - 2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
 - 3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
 - 4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.
- C. Sealing:
 - 1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.

2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke, and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.
- D. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
 2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
 3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
 4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.06 CONCEALED IN CONCRETE

- A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.
- B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.
- C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
- D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.
- E. Make couplings and connections watertight.
- F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.07 TERMINATIONS AND JOINTS

- A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.
- B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
- C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where

- terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.
- D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
 - E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.
 - F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets, or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.
 - G. Raceway seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times its original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms: water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects, and rodents. Install raceway sealing foam at the following points:
 - 1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.).
 - 2. Where conduits enter buildings from below grade.
 - H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
 - 1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
 - 2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a green copper ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.
 - I. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease, or water. Provide a green ground wire with FMC or LFMC conduit.

3.08 HAZARDOUS LOCATIONS

- A. Use rigid steel conduit only.
- B. Install UL approved sealing fittings that prevent passage of explosive vapors in accordance with the Manufacturers written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank coverplate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - 1. Where conduits enter or leave hazardous locations.
 - 2. At luminaires, switches, receptacles and as required by the CEC.

3.09 SUPPORTS

- A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.
- B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the CEC.
- C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.
- D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.
- E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.
- F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.
- G. Fasteners and supports in solid masonry and concrete:
 - 1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. After concrete installation:
 - a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8" embedment.
 - b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.
- I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION

SECTION 26 05 33
BOXES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Wall and ceiling outlet boxes.
 - 2. Pull and junction boxes.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 08: Access doors. Wall and ceiling access doors.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. American National Standards Institute/National Electrical Manufacturer Association:
 - ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
 - ANSI/NEMA OS-2; Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
 - NEMA 250; Enclosures for Electrical Equipment (1000 volts maximum).
 - 2. Underwriters Laboratories (UL):
 - UL 50; Enclosures for Electrical Equipment.
 - UL 514A; Metallic Outlet Boxes.
 - UL 1773; Termination Boxes.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Outlet and junction boxes:
 - a. Spring City Electrical Manufacturing Co.
 - b. Thomas & Betts Corp.
 - c. Raco, Inc.
 - 2. Cast boxes:
 - a. Appleton Electric Co.
 - b. Crouse-Hinds.
 - 3. Floor boxes:
 - a. Legrand.
 - b. Hubbell Inc.
 - c. Raceway Components, Inc.
 - 4. Pullboxes:
 - a. Circle AW Products.
 - b. Hoffman Engineering Co.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 OUTLET BOXES

- A. Standard outlet box:
 - 1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
 - 2. 4-inch square by 2-1/4-inch deep shall be minimum box size.
 - 3. ANSI/NEMA OS 1.
- B. Concrete box:
 - 1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
 - 2. Select height as necessary to position knockouts above concrete reinforcing steel.
 - 3. ANSI/NEMA OS 1.

- C. Tile box:
 - 1. Provide outlet boxes for installation in tile or concrete block walls.
 - 2. Standard outlet boxes with raised, square corners and device covers are acceptable.
 - 3. ANSI/NEMA OS 1.
- D. Cast metal outlet body:
 - 1. Provide 4-inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
 - 2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.
- E. Conduit outlet body: Provide malleable iron, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.03 PULL AND JUNCTION BOXES

- A. Sheet metal pull and junction box:
 - 1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
 - 2. ANSI/NEMA OS 1.
- B. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Install all outlet boxes flush with building walls, ceilings, and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.
- B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.
- C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
- D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.
- E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed luminaires.

- F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire-rated walls separate boxes by at least 24" and wall stud.
- G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.03 INSTALLATION

- A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.
- C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.
- D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended, or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
- E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.
- F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.
- G. Welded outlet boxes shall only be used in concealed interior installations.
- H. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.
- I. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.
- J. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.
- K. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.
- L. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.
- M. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.
- N. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.04 SUPPORTS

- A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.
- B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16-gauge metal channel bars attached to main ceiling runners.
- C. Support boxes independently of conduit system.

- D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted luminaires are to be installed from the box.
- E. Support boxes mounted above suspended acoustical tile ceilings, directly from the structure above.

END OF SECTION

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Electrical equipment nameplates.
 - 2. Panelboard directories.
 - 3. Wire and cable identification.
 - 4. Buried electrical line warnings.
 - 5. Junction box identification.
 - 6. Warning and caution signs.
 - 7. Inscribed device coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 09: Painting.

1.02 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Conduit and wire markers:
 - a. Thomas & Betts Corp.
 - b. Brady.
 - c. Griffolyn.

2. Inscription Tape:
 - a. Kroy.
 - b. Merlin.
 - B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.
- 2.02 NAMEPLATES
- A. Type NP: Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20-square inches or 8-inches in length; 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.
 - B. Color and letter height as specified in Part 3: Execution.
- 2.03 LEGEND PLATES
- A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.
 - B. Stamped characters to be paint filled.
- 2.04 BRASS TAGS
- A. Type BT: Metal tags with die-stamped legend, punched for fastener.
 - B. Dimensions: 2" diameter 19 gauge.
- 2.05 PANELBOARD DIRECTORIES (400 AMP OR LESS)
- A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.
 - B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126) for all 42-pole panelboards. For 84-pole panelboards the numbering is Section 1 (circuit numbers 1-84), Section 2 (circuit numbers 85-168), etc.
- 2.06 WIRE AND TERMINAL MARKERS
- A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips.
 - B. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.
- 2.07 CONDUCTOR PHASE MARKERS
- A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.
- 2.08 UNDERGROUND CONDUIT MARKER

- A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

2.09 INSCRIBED DEVICE COVERPLATES

- A. Coverplate material shall be as specified in Section 262726: Wiring Devices.
- B. Methods of inscription: (Unless otherwise noted)
 - 1. Type-on-tape:
 - a. Imprinted or thermal transfer characters onto tape lettering system.
 - b. Tape trimmer.
 - c. Matte finish spray-on clear coating.
 - 2. Engraving:
 - a. 1/8" high letters.
 - b. Paint filled letters finished in black.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 NAMEPLATES

- A. Installation:
 - 1. Degrease and clean surfaces to receive nameplates.
 - 2. Install nameplates parallel to equipment lines.
 - 3. Secure nameplates to equipment fronts using machine screws.
- B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
 - 1. Equipment or device designation:
 - a. Equipment designations shall conform to the following:
 - 1) Building number designation – 1.
 - 2) Power source:
 - a) Normal - __
 - b) Emergency – E
 - 3) Equipment description:
 - a) Main switchboard – MS
 - b) 277/480volt distribution board – HD
 - c) 277/480volt panelboard – H

- d) 120/208volt distribution board – LD
 - e) 120/208volt panelboard – L
 - f) Transformer – TX
- 4) Floor number where equipment is located – 03
- 5) Equipment designation – B
- b. Example: 2EHD03A
 - 1) Building number 2.
 - 2) Emergency source.
 - 3) 277/480volt distribution board.
 - 4) Floor level 03.
 - 5) Board designation A
- 2. Amperage, KVA or horsepower rating, where applicable.
- 3. Voltage or signal system name.
- 4. Source of power or control.
- 5. Examples:
 - a. Boards: 2EHD03A; 1200A, 277/480volt, 3-phase, 4-wire; Served from 2EATS03A
 - b. Transformers: 2ETX03A; 150KVA, 480volt primary, 120/208volt, 3-phase, 4-wire secondary; Served from 2EHD03A; Load Served: 2EL03A
 - c. Disconnects or Individual Motor Starters: EF-1; 20HP; 480volt, 3-phase,3-wire; Served from 2EHD03A
- C. Nameplates for power system distribution equipment and devices are to be black.
- D. Nameplates for signal systems equipment and devices are to be black except as follows:
 - 1. Fire alarm and life safety - Red.
- E. Minimum letter height shall be as follows:
 - 1. For panelboards, switchboards, battery panels, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
 - 2. For individual circuit breakers, switches and motor starters in panelboards, distribution boards, and switchboards use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
 - 3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
 - 4. For transformers use ½-inch letters to identify equipment designation. Use ¼-inch letters to identify primary and secondary voltages, etc.
 - 5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.03 LEGEND PLATES

- A. Provide panel-mounted operators devices such as pilot lights, reset buttons, "HAND-OFF-AUTO" switches, etc.

3.04 BRASS TAGS

- A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.
- B. Provide tags for all feeder cables in underground vaults and pull boxes.
- C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.05 PANELBOARD DIRECTORIES (400AMP OR LESS)

- A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.
- B. Verify room numbers or area designation with Project Manager.
- C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.06 WIRE AND CABLE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboards, pull boxes, outlet, and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.
- B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3-inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.07 UNDERGROUND CONDUIT MARKERS

- A. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.08 JUNCTION BOX IDENTIFICATION

- A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.09 WARNING, CAUTION, AND INSTRUCTION SIGNS

- A. Provide warning, caution or instruction signs where required by CEC, where indicated or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic laminated instruction signs

- with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
- B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding or other emergency operations.
 - C. Elevator Machine Rooms(s): Provide warning sign for each elevator controller disconnect to read "Warning - Part of the Control Panel is not De-energized by this Switch."
 - D. Elevator car light and fan switch: Provide signage indicating elevator number serving and function of each switch.

3.10 INSCRIBED DEVICE COVERPLATE

A. General:

- 1. Lettering type: Helvetica, 12 point or 1/8" high.
- 2. Color of characters shall be black.
- 3. Locate the top of the inscription 1/2" below the top edge of the coverplate.
- 4. Inscription shall be centered and square with coverplate.

B. Application:

- 1. Type-on-tape inscriptions shall be provided for the following devices:
 - a. Receptacles.
 - b. Outlets in surface raceways.
 - c. Telecommunication outlets.
- 2. Engraved inscriptions shall be provided for the following devices:
 - a. Multi-ganged switches.
 - b. Special purpose switches.
- 3. Type-on-tape installation:
 - a. Tape shall be trimmed to the height of the letters.
 - b. Trim tape length to 1/4-inch back from each edge of coverplate.
 - c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION

SECTION 26 09 42
DIGITAL LIGHTING CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Lighting control modules
 - 2. Occupancy sensors.
 - 3. Emergency bypass relays or transfer device.
 - 4. Startup and field quality control.
 - 5. Commissioning.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 25 – Building Automation System (BAS): Lighting control interface.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. National Electrical Manufacturer Association (NEMA):
 - NEMA 250; Enclosures for Electrical Equipment.
 - NEMA ICS 1; Industrial Control and Systems.
 - NEMA ICS 4; Terminal Blocks and Industrial use.
 - NEMA ICS 6; Enclosures for Industrial Controls and Systems.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 50; Cabinets and Boxes.
 - UL 773A; Nonindustrial Photoelectric Switches for Lighting Control.
 - UL 916; Energy Management.
 - UL 924 Standard for emergency lighting and power equipment.
 - UL1008 Transfer switch equipment.

1.03 SYSTEM DESCRIPTION

- A. A standalone digital lighting control system that interconnects and lighting components such as occupancy and daylight sensors, control stations, etc. to control luminaires connected to the system. All components are locally connected and function independently of any central control software.
- B. Control of luminaries will come from distributed control modules capable of "ON/OFF" control and 0-10volt dimming. The system shall be capable of dimming other loads such as electronic low voltage (ELV) and magnetic low voltage (MLV).
- C. The lighting control components shall be capable of adjusting their specific parameters such as dimming presets, time delays, etc. per the device type. Handheld or computer-based commissioning tools shall be available during startup to reduce the time required at startup and commissioning. These tools shall be available to the Owner after startup and commissioning.
- D. The control system is connected independent of electrical lighting circuits.
- E. The system shall utilize either hardwired or wireless components.

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment and dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 - 5. Submit Manufacturer's installation instructions.
 - 6. Complete bill of materials listing all components.
 - 7. Warranty.

1.05 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements to include the following:
 - 1. Operation and maintenance manuals shall include the following:
 - a. A detailed explanation of the operation of the system.
 - b. Instructions for routine maintenance.
 - c. Pictorial parts list and part numbers.
 - 2. Telephone numbers for the authorized parts and service distributors.
 - 3. Final testing report.

1.06 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Digital lighting control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.08 WARRANTY

- A. Units and components offered under this Section shall be covered by a minimum 2-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Network addressable lighting control system:
 - a. Wattstopper "DLM".
 - b. Acuity "nLight".
 - c. Douglas "Dialog".
 - d. ETC "Echo".
 - e. Eaton "Greengate Room Controller".
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

- A. The lighting control system shall be standalone with no central control software. Lighting components shall tie together and communicate directly with each other as required for the device type.
- B. Control stations, occupancy sensors, and daylight sensors shall tie into dimming and relay modules to control luminaires.

- C. The control parameters shall be set within each device, either as dip switches or dials on the device itself or with handheld or computer-based commissioning tools. The parameters remain set until they are manually changed.
- D. Daylight sensors shall rationalize changes to light levels when daylight is available and shall maintain a steady light level when subjected to fluctuating ambient conditions.
- E. Where required in a sequence of operation an astronomical time clock function shall be integrated into the control modules or relay panels.
- F. During an emergency condition (loss of normal power), the system shall not impede the emergency lighting to function properly, i.e. the control system shall control emergency lighting to turn on at full light output and lock out user controls.
- G. The control system shall allow occupancy sensor, when relaying a vacant status to either turn lights off or dim lights to a preset level.
- H. The control system components shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission.

2.03 LIGHTING CONTROL MODULES

A. General:

- 1. Lighting control modules provide an interface between the control system and luminaires. Modules take inputs from the system and convert the commands through the power and control wiring to the fixture providing "ON/OFF/DIMMING" functions.
- 2. Lighting control modules contain a 16amp minimum rated relay(s) for "ON/OFF" control as well as a 0-10volt dimming signal. Modules shall also have the capability of two wire phase dimming (MLV or ELV).
- 3. In the event of a power failure, control modules connected to luminaires shall default to the "on" state at full light output.

B. The following lighting control modules shall be available with the system, at a minimum:

- 1. Single zone 0-10volt control module with a relay.
- 2. Multi-zone 0-10volt control module with one relay per 0-10volt zone ("Room Controller").
- 3. Single zone two wire dimming module (Incandescent, MLV, or ELV) with a relay.
- 4. Multi-zone two wire dimming module (Incandescent, MLV, or ELV with one relay per zone ("Room controller"))

C. Mounting:

- 1. Single zone modules shall have a ½" nipple to mount directly to a ½" knockout on a junction box.
- 2. Multi-zone modules shall mount stand alone or onto a 4 square junction box.

2.04 PLUG LOAD CONTROL MODULES

A. General:

1. Plug load Control modules provide an interface between the control system and controlled outlets. Modules take inputs from the system and convert the commands through the power wiring to the receptacle(s) being controlled.
2. Control modules contain a 20amp rated relay(s) for "ON/OFF" control.

B. Mounting:

1. Modules shall have a ½" nipple to mount directly to a ½" knockout on a junction box.

2.05 CONTROL STATIONS

A. General:

1. The controllers are configurable wall mounted devices that provide local "ON/OFF/DIMMING" control to lighting zones.
2. Each device can be set-up and modified through the control systems software interface.

B. Dimmer switch controller:

1. Software configurable dimmer switch that provides "ON/OFF" switching and the capability to dim.
2. Dimming to be continuous over the full range of the driver or ballast it is controlling.

C. Dimming scene controller:

1. Multi-button controller allowing the end user to recall zones or scenes for "ON/OFF/DIMMING" control.
2. Scenes are made up of multiple zones, where each zone is dimmed to a specific light output.
3. Scene configuration can be changed via control systems software.
4. The scene controller shall also allow for a custom labeling feature that allows scene labels on the controller to be easily modified.

D. Specifics:

1. Mounting:

- a. Controllers utilize a standard single-gang device strap configuration for ease in mounting. Where multiple controllers are ganged together, they shall allow for a single multi-gang cover plat to be used.
- b. Mounts to standard switch box or cut-in ring.

2. Controllers shall tie to the system in one of the following ways:

- a. Hardwired low voltage, wiring and connections per manufacturer's requirements.
- b. Wireless with a 10-year minimum battery life. Mechanically triggered wireless switches shall not be allowed unless approved by The Owner.

2.06 OCCUPANCY SENSOR

A. General:

1. Occupancy sensors shall automatically detect movement within a space, reporting the state of occupancy to the control modules for "ON/OFF/DIMMING" control of lighting zones and "ON/OFF" control of the controlled receptacle circuits within that space.
 2. All setpoints for the occupancy sensor shall be accessible on the device or through the commissioning tool.
 3. Sensors shall capable of being linked together via hard wired connections to provide a larger coverage area.
 4. Provide enough occupancy sensors as required for complete area coverage they are installed in, regardless of how many sensors are shown on the Drawings.
- B. Specifics:
1. Sensor shall have a coverage of 1,000 square feet. Manufacturer to provide additional sensors if coverage is less than 1,000 square feet.
 2. Sensors shall be infrared or dual technology or microphonic. Dual technology sensors shall be capable of disabling either infrared or ultrasonic sensing.
- 2.07 EMERGENCY BYPASS RELAYS
- A. General:
1. System manufacturer shall provide emergency bypass relays as shown on the Drawings.
 2. The bypass relay device shall take an uncontrolled normal sensing hot, uncontrolled emergency hot, and controlled normal circuit as inputs.
 3. The device shall bypass the controlled normal hot and control signal at the loss of power from the normal sensing hot and allow the uncontrolled emergency hot to power the downstream luminaires.
 4. The device shall be capable of accepting a 0-10volt control signal and breaking if the downstream fixtures are 0-10volt controlled.
- B. Specifics:
1. Mounting: directly onto a junction box or integral to the luminaire.
 2. UL924 rated for switched and dimmed loads.
 3. Where more than six bypass relays are located in a central location provide an enclosure to mount all devices.
- 2.08 EMERGENCY TRANSFER DEVICE
- A. General:
1. System manufacturer shall provide emergency transfer devices as shown on the Drawings.
 2. The transfer devices shall take an uncontrolled normal sensing hot, uncontrolled emergency hot, and controlled normal circuit as inputs.
 3. The device shall transfer be an open transition "make before break" type. The normal controlled circuit shall transfer to emergency circuit at the loss of power from the normal sensing hot and allow the uncontrolled emergency hot to power the downstream luminaires.

4. The device shall be capable of accepting a 0-10volt control signal and breaking if the downstream fixtures are 0-10volt controlled.
- B. Specifics:
1. Mounting: directly onto a junction box.
 2. UL1008 rated for switched and dimmed loads.
 3. Where more than six transfer devices are located in a central location, provide either an enclosure or panel housing to mount all devices within.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of low-voltage lighting control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. Install the addressable lighting control system in accordance with the Manufacturer's written instructions, as indicated on the drawings and as specified herein.
- B. Locate relay panel(s) where indicated on the plans.
- C. All interior luminaires shall be controlled via the control system unless otherwise noted on the plans. Refer to the drawing symbols list for the differentiation between networked luminaire devices and standalone devices.

3.03 ATTIC STOCK

- A. Spare Parts: Provide spare parts totaling 5 percent of the quantity specified, or two total, whichever is greater, of the following:
1. Control Modules (provide for each type used on the project):
 2. Occupancy Sensors:
 3. Daylight Sensors:
 4. Dimmer Switches (provide for each type used on the project):

3.04 OCCUPANCY SENSOR

- A. Occupancy sensors shall be placed in a location that provides maximum coverage and minimizes false positives such as being triggered through an open door.
- B. Refer to the architectural RCPs and locate sensors as shown or if not shown, locate in line with other ceiling devices while still maximizing area coverage.
- C. Where the coverage of a sensor is inadequate for the space it is being installed in, the manufacturer shall provide additional sensors for the contractor to install. The cost of these sensors and installation shall be included at the time of bid.

3.05 DAYLIGHT SENSORS

- A. Locate daylight sensors per the manufacturer's requirements in order to provide accurate electric and daylight light levels.

B. Coordinate the final location of the sensor with other devices in the area.

3.06 CONTROL MODULES

A. Install all control modules per the shop drawings and manufacturer's requirements. Ensure devices are in an accessible location. Avoid locations where the devices are visible to the public.

3.07 AUXILIARY DEVICES

A. Where devices, not covered under these Division 26 specifications, are required to provide a complete lighting control system, furnish and install such devices per the manufacturer's instructions.

3.08 STARTUP AND FIELD QUALITY CONTROL

A. General:

1. All work related to the startup of the addressable lighting control system shall be by a factory-authorized agent of the Manufacturer of the system along with the assistance of the electrical contractor.
2. All programming, testing, trouble shooting, etc. shall be included in this contract.

B. Prefunctional resting:

1. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers, and doors are secure.
2. Contractor shall provide all necessary programming assistance to set up and program the lighting control parameters.
3. Electrical tests:
 - a. The system shall be completely tested in accordance with operational parameters, tolerances, and Manufacturer's instructions. Any problem shall be documented and corrected.
 - b. Test all control circuits and verify proper operation of all lighting circuits throughout the control system.
 - c. Ensure the lighting zone controls match that of the Contract Documents.
 - d. Verify the proper integration with the mechanical control system for override control and monitoring of low-voltage lighting control system.
 - e. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.

C. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

- D. Contractor shall submit the testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.09 COMMISSIONING

A. General:

1. Once startup of the system is complete and no defects to the system are detected the commissioning process shall begin; furthermore, it is acceptable to program the system per the commissioning requirements during the startup phase.
2. All work related to the commissioning of the digital lighting controls shall be by the electrical contractor or by a factory-authorized agent of the Manufacturer of the system.
3. At least three weeks prior to any commissioning verification, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
4. Refer to the Lighting Control Sequence of Operation on the Drawings.

B. Occupancy sensors:

1. All occupancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.
2. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to 15 minutes.

C. Daylight sensors:

1. Where no direction is provided in a sequence of operation or by the owner, the daylight sensor setpoint to dim the electric light should be at 150% of the maximum electric light output.

D. Scene controllers:

1. Where no scenes have been described in a sequence of operation or by the owner the contractor shall provide the following scenes as appropriate for the space:
 - a. Scene 1: All luminaires on at 100%
 - b. Scene 2: Luminaires near screen displays off, all other luminaires on at 75%.
 - c. Scene 3: All indirect luminaires off, all direct luminaires on at 100%.
 - d. Scene 4: All direct luminaires off, all indirect luminaires on at 100%.
 - e. Scene 5: All luminaires off.

E. Time schedules:

1. All time schedules required shall be done through an astronomical time clock integral to the devices and equipment. The building location and date shall be programmed to ensure proper time schedule functions.
2. If no sequence of operations is provided program time schedules as follows:
 - a. Interior spaces: Per owner's direction, do not assume hours of operation.

- b. Exterior spaces: on 30 minutes before sunset, and off 30 minutes after sunrise.
- F. Third party commissioning:
 - 1. Refer to Specification Section 260800: Electrical Commissioning.
 - 2. The purpose of third-party commissioning shall be to verify the system's functionality and parameters as detailed on the Drawings and specifications. The contractor and factory agent are still responsible for performing the startup and commissioning of the system.
- G. Contractor shall be responsible for all acceptance testing requirements related to the lighting control system as outlined in the California Energy Code Title 24 Part 6.

3.10 TRAINING

- A. Refer to Specification Section 260800: Electrical Commissioning.
- B. Factory authorized service representative shall conduct a 1-hour training session for Owner's Representatives upon completion and acceptance of system. Instruction shall include operation, programming, and maintenance of equipment.
- C. Any special commissioning / configuration tools required to program the lighting control system shall be provided to the district representative upon completion of training.
- D. Contractor shall schedule training with a minimum of 7 days advanced notice.

END OF SECTION

SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Distribution switchboards (800 amps and greater).
 - 2. Outdoor enclosure and accessories.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 03: Cast-in-place concrete. Equipment housekeeping pad.
 - 3. Division 09: Painting. Touch-up of painted surfaces.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI):
 - ANSI C12; Code for Electricity Metering.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 486E; Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
 - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - UL 869A; Service Equipment.
 - UL 891; Dead-Front Switchboards.
 - UL 943; Ground-Fault Circuit Interrupters.
 - UL 1053; Ground-Fault Sensing and Relaying Equipment.
 - 3. National Electrical Manufacturer Association (NEMA):
 - NEMA AB1; Molded Case Circuit Breakers.
 - NEMA PB 2; Deadfront Distribution Switchboards.

NEMA PB 2.1;	General Instruction for Proper Handling, Installation, Operation and Maintenance of Dead front Distribution Switchboards Rated 600 Volts or less.
NEMA PB 2.2;	Application Guide Ground Fault Protective Devices for Equipment.
NEMA SG5;	Power Switchgear Assemblies.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Shop Drawings to include:
 - a. Front, plan, and side view elevations with overall dimensions.
 - b. Conduit entrance locations and requirements.
 - c. Nameplate legends; size and number of bus bars per phase, neutral and ground.
 - d. Switchboard instrument details and accessories.
 - e. Electrical characteristics including voltage, frame size and trip rating and withstand ratings.
 3. Outdoor weatherproof equipment enclosure and accessories.
 4. Submit Manufacturer's installation instructions.
 5. Complete Bill of Material listing all components.
 6. Final test results.
 7. Warranty.
- B. Dimensions and configurations of switchboards shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.
- C. Service entrance switchboard utility metering sections shall be submitted to the local electrical utility company for approval prior to submission to the Engineer. A letter of acceptance from utility company shall be included in submittal package.

1.04 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Pictorial parts list and part numbers.

4. Pictorial and schematic Electrical Drawings of wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators.
5. Telephone numbers for the authorized parts and service distributors.
6. Include all service bulletins and torque Specifications for all terminations.
7. Final testing report.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Switchboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with NEMA PB2.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

- A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.08 EXTRA MATERIAL

- A. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Square D.
 2. ABB/ General Electric.
 3. Eaton.

4. Siemens.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.
- 2.02 SWITCHBOARDS - GENERAL
- A. Enclosure:
1. Each switchboard shall consist of a dead front, completely metal enclosed self-supporting structure. Construction shall consist of vertical sections of the universal frame type bolted together and braced with self-tapping bolts. Sides, top and rear shall be covered with captive-bolt fastened steel plates having formed edges all around. Front plates shall be sectionalized and removable. All plates shall be fabricated from 12-gage steel and shall have die-formed edges all around. The switchboard frame shall be suitable for use as floor sills in indoor installations. Corners shall be reinforced with rigged gussets internal and external to the structural members.
 2. Switchboards shall have depth as required to house all equipment contained within it. Switchboard shall be constructed so that the back and front of all sections align. Construction of the board shall allow maintenance of incoming line terminations, device connections and all bus bolted connections.
 3. All devices shall be accessible and removable from the front unless rear access is indicated on the Drawings.
 4. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.
 5. Provide hinged access doors to all termination, meter, and relay compartments with knurled and slotted large head captive-bolts. The design shall allow access to compartments without tools and without removing any panels.
 6. Furnish cable pull sections or top cable pull boxes where indicated on the Drawings complete with cable tie down supports. Where cable pull section or pull boxes contain utility service cables, provide utility acceptable sealing means.
 7. Switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.
 8. Utility metering compartment section shall be fabricated to meet all utility company requirements. Where separate vertical section is required for utility metering, match and align with switchboard enclosure.
- B. Bus assembly and terminations:
1. The switchboard bussing shall be highly conductive silver-plated copper with sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements.
 2. Bus arrangement shall be Phase A-B-C-N left-to-right, top-to-bottom and front-to-rear as viewed from the front. Horizontal and vertical bus ampere rating shall be uniform from end-to-end.
 3. All bussing to and from an overcurrent protective device shall be rated to the frame sizing, not the trip rating.

4. Where "SPACE" is indicated in the switchboards, cross connectors and mounting hardware shall be installed to match the frame size ampere rating noted on the Electrical Drawings. All "SPACES" shall be ready for installation of overcurrent protective devices at a future time.
 5. Shipping splits and provisions for future bus extension shall be provided with necessary bus splices.
 6. Each switchboard shall contain a full length, bottom/front located copper ground bus that is securely connected to each vertical section. Ground bus shall be sized in accordance with UL 891, Table 25.1.
 7. Termination lugs: High compression circumference crimped type rated for use with aluminum/copper conductors.
 8. Switchboards shall be fully rated for a minimum of 65,000 AIC or as indicated on the Drawings.
 9. Neutral bus shall be 100-percent rated unless otherwise indicated on the Drawings.
 10. Main service switchboards:
 - a. Removable neutral link: Provide removable bolted bus section for the purpose of disconnecting the ground circuit conductor from the premises wiring at the supply side of the service in accordance with CEC article 230-75.
 - b. Main bonding jumper: Connection between the grounded circuit conductor and the equipment ground conductor at the supply side of the service. Size in accordance with CEC table 250-94 or 12-1/2% of the area of the largest phase conductor in accordance with CEC article 250-79(c).
- C. Switching and overcurrent protective devices:
1. Refer to Section 262816: Overcurrent Protective Devices.
 2. Main overcurrent protective device(s) shall be fixed mounted molded case circuit breaker with interrupting rating and frame and trip ratings as indicated on Drawings.
 3. Feeder overcurrent protective device(s) shall be fixed mounted molded case circuit breaker with frame and trip rating as indicated on Drawings.
 4. Devices interrupting rating shall match that of switchboard for which the device is installed.
 5. Series ratings of overcurrent protective devices is not acceptable unless specifically noted on the Drawings.
 6. Devices shall be manually operated unless shunt trip and/or electrically operated devices are indicated on Drawings.
- D. Ground fault protection:
1. General: A solid-state, zone-interlocked, ground fault protection system shall be provided integral on the main device(s) as indicated on Drawings. It shall consist of integral phase current sensors, appropriate solid-state relaying equipment to provide

the desired ground fault current sensitivity and time-current response characteristics. Provide neutral ground fault current transformer for four wire systems.

2. Device settings: Adjustable pickup current sensitivity for ground fault currents from 200 amperes to 1200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Time delay shall be adjustable from 0 to 60 cycles. Settings for individual relays shall be as directed by the short circuit/coordination study specified in Section 260060: Power System Study. A locking screw shall be provided to retain both adjustments at desired setting.
 3. All overcurrent devices shall be independently time coordinated irrespective of zone interlocking to allow the last downstream level of ground fault devices to be time coordinated, i.e. it shall NOT revert to the lowest time setting.
- E. Surge Protective Devices:
1. Refer to Section 264313: Surge Protective Devices.
- F. Instrumentation and controls:
1. Switchboards shall have a digital meter unit (DMU) as indicated on the Drawings. DMU shall be by the same manufacturer as the switchboard.
 2. Meter potential circuits shall be fused. Potential transformers if required for the monitoring devices shall be provided with fuses in the primary.
 3. Meter current circuits shall have shorting terminal blocks between the meter and the current transformers. Current transformers shall be ring type (one per phase) with ratio, thermal, and mechanical ratings coordinated with the application and protection.
 4. Instrument transformer accuracy per IEEE C57.13.6:
 - a. Current transformers must maintain 0.3% accuracy from 5% rated current through rating factor at rated burden.
 - b. Voltage transformers must maintain 0.15% accuracy from 90% to 110% of rated voltage.
 5. All internal devices (relays, transformers, etc.) shall be tagged as to rating and function with permanently fastened engraved nameplates.
 6. Control and signal circuits: Control devices, i.e.: contactors, relays, time clocks, etc. shall be mounted in a separate compartment that is fully barrier from the overcurrent protective device compartments. Control devices shall be accessible through a separate hinged cover panel.
 7. Relays: All relays shall be industrial control grade with a "ON" indicating neon light, hold down springs, minimum of 10amp rated contacts and a minimum of four form C contacts. Relays used for control power transfer shall have 20amp rated contacts. Do NOT use paralleled relays for relays with greater than 4-poles, use relays with the required number of poles. This is to prevent the situation where one relay fails, and half of the intended function is lost, which could be dangerous.
- G. Refer to Electrical Drawings for the following:

1. Mounting style; voltage; terminal lug size, location, and quantity; bus ampacity; interrupting capacity of bus and overcurrent protective devices, quantity, poles, and rating of overcurrent protective devices. Note that the AIC value noted on the Drawings for distribution equipment is the minimum rating of all components; values are in RMS symmetrical amps.
 2. If indicated on the Electrical Drawings, provide contactors, relays, time clocks, etc. mounted within switchboard.
- H. Miscellaneous requirements:
1. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side.
 2. Nameplates: Engraved nameplates shall be provided for each device and all "SPACES" located in the switchboard. An engraved nameplate shall also be provided indicating the switchboard designation. See Section 260553: Electrical Identification for requirements.
 3. All control wires shall be labeled with wire markers and referenced to the control wiring diagrams. Provide colored wires with colored stripes to facilitate troubleshooting and locating both ends of wires. Do not use wires with all the same wire color. Use fork, crimp type terminations on all control wires.
 4. Provide a test block and plugs for voltage and current monitoring at each main switch. Provide engraved legend plates to indicate function of each test point.
 5. Vertically mounted mains shall have the operating handle in the up position when energized.
- I. Weatherproof outdoor enclosure and accessories:
1. Provide a NEMA 3R non-walk-in type weatherproof housing with hinged lockable access doors. Each section shall have a minimum of 13-inch deep vestibule. Provide a latch for each door to ensure adequate closing pressure to seal against harmful weather.
 2. The weatherproof housings shall be provided with lifting eyes.
- J. Finish:
1. Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).
 2. A seven-step spray wash electroplate primer with final baked-on enamel finish; ANSI 61 (light gray) is an acceptable finish alternative.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of switchboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Ensure all conduit stub-ups for bottom entry into switchboard are in place and located as required per Shop Drawings.
- B. Whether noted on the Drawings or not, provide a 4-inch high concrete housekeeping pad beneath equipment. Coordinate actual sizes of equipment based on approved Shop Drawings and extend pad 4-inches in all directions beyond overall dimension of base. Provide reinforcing bars as required structurally within pad to ensure proper support of equipment. **In addition to housekeeping pad, add concrete working space min 48" depth.**

3.03 INSTALLATION

- A. Install switchboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Handling, storage, installation and energize of switchboards shall be carried out in accordance with latest edition of NEMA Publications PB 2.1.
- C. Freestanding switchboards shall be accurately aligned, leveled, and bolted in place on full-length channels securely fastened to concrete floor.
- D. Switchboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.
- E. Provide mounting hardware brackets, bus bar drilling and filler pieces for all unused spaces.
- F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.
- G. Replace any panel pieces, doors or trims having dents, bends, warps, or poor fit that may impede ready access, security, or integrity.
- H. Conduits terminating in concentric, eccentric, or oversized knockouts at switchboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the switchboards.
- I. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.
- J. Visually inspect switchboards for rust and corrosion if signs of rust and corrosion are present, board shall be restored to new condition or replaced.
- K. In damp and wet locations mount switchboard with a minimum 1 inch of air space between enclosure and the wall or other supporting material.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, testing, and adjustment of the switchboard.
- B. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements. Testing Agencies objectives shall be to:
 - 1. Assure switchboard installation conforms to specified requirements and operates within specified tolerances.

2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 3. Prepare final test report including results, observations, failures, adjustments, and remedies.
 4. Apply label on switchboard upon satisfactory completion of tests and results.
 5. Verify ratings and settings and make final adjustments.
- C. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- D. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.
- E. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.
- F. Prefunctional testing:
1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 2. Visual and mechanical inspection:
 - a. Compare nameplate information and connections to Contract Documents.
 - b. Inspect for physical damage, defects alignment and fit.
 - c. Verify appropriate anchorage, required clearances and correct alignment.
 - d. Inspect doors, panels and sections for paint, dents, scratches, fit and missing hardware
 - e. Check tightness of all control and power connections.
 - f. Check that all covers, barriers, and doors are secure.
 - g. Verify correct barrier installation.
 - h. Verify that relays and overcurrent protective devices meet Drawing, power system study and specified requirements.
 - i. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - j. Exercise active components.
 - k. Inspect control power and instrument transformers.
 - l. Inspect insulators for evidence of physical damage or contaminated surfaces.
 - m. Ground-fault protection:
 - 1) Verify ground connection is made ahead of neutral disconnect link and on line side of any ground fault sensor.

- 2) Verify neutral sensors are connected with correct polarity on both primary and secondary.
 - 3) Verify all phase conductors and neutral pass through sensor in same direction for zero sequence systems.
 - 4) Verify grounding conductors do not pass through zero sequence sensors.
 - 5) Verify grounded conductor is solidly grounded.
 - 6) Verify correct operation of self-test panel.
 - 7) Set pickup and time-delay settings in accordance with Specifications. Record operation and test sequences as required by code.
3. Electrical tests:
- a. Perform resistance tests through bus joints with low-resistance ohmmeter. Joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.
 - b. Perform insulation-resistance tests on each bus section, phase-to-phase, and phase-to-ground, at 1000volt DC for 60-seconds. Investigate resistance values less than 50-megohms.
 - c. Perform over-potential test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with Manufacturer's published data. Test voltage shall be applied for 60-seconds.
 - d. Perform insulation-resistance tests at 1000volt DC for 60-seconds on control wiring. Do not perform this test on wiring connected to solid-state components.
 - e. Perform current injection tests on the entire current circuit in each section of switchgear.
 - 1) Perform current tests by primary injection, where possible, with magnitudes such that minimum of 1amp flows in secondary circuit.
 - 2) Where primary injection is impractical, utilize secondary injection with minimum current of 1amp.
 - 3) Test current at each device.
 - f. Perform tests on all instrument transformers in accordance with Manufacturer's written instructions.
 - g. Determine accuracy of meters and instruments per Manufacturer's instructions.
 - h. Perform the following tests on control power transformers:
 - 1) Perform insulation-resistance test. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be determined in accordance with Manufacturer's instructions.
 - 2) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm potential at all devices.

- 3) Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with secondary wiring disconnected.
 - i. Potential transformer circuits:
 - 1) Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be determined in accordance with Manufacturer's instructions.
 - 2) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage.
 - 3) Verify secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with secondary wiring disconnected.
 - j. Ground resistance:
 - 1) Measure system neutral-to-ground insulation-resistance with neutral disconnect link temporarily removed. Replace neutral disconnect link after test.
 - 2) Measure insulation-resistance of control wiring at 1000volt DC for 60-seconds. Refer to Manufacturer's instruction for devices with solid-state components
 - k. Ground fault protection system:
 - 1) Perform the following pickup tests using primary injection:
 - a) Verify relay does not operate at 90% of pickup setting.
 - b) Verify pickup is less than 125% of setting or 1200amps, whichever is smaller.
 - 2) Measure time delay of the relay at 150% or greater of pickup.
 - l. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.
4. Test values:
- a. Bolt torque levels shall be in accordance with Manufacturer's requirements.
 - b. Compare bus connection resistances to values of similar connections.
 - c. Insulation-resistance values for bus, control wiring and control power transformers shall be in accordance with Manufacturer's published data. Values of insulation resistance less than Manufacturer's minimum levels should be investigated. Over-potential tests should not proceed until insulation-resistance levels are raised above minimum values.
 - d. Insulation shall withstand the over-potential test voltage applied.
 - e. Determine contact resistance in microhms. Resistance values shall not exceed high limit of normal range as indicated in Manufacturer's published data.
 - f. System neutral-to-ground insulation shall be a minimum of one megohm.
 - g. Ground fault protection systems relay timing shall be in accordance with Manufacturer's Specifications but must also be no longer than one second at 3000amps.

- G. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
- H. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- I. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.05 CLEANING

- A. Prior to energizing of switchboard, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.
- B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of switchboard per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.06 TRAINING

- A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.
- B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Wall switches.
 - 2. Occupancy/vacancy sensors, including wallbox and ceiling mounted.
 - 3. Time switches.
 - 4. Receptacles.
 - 5. Coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 03: Cast-in-place concrete.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. National Electrical Manufacturer's Association (NEMA):
 - NEMA WD-1; General-Purpose Wiring Devices.
 - NEMA WD-2; Semiconductor Dimmers for Incandescent Lamps.
 - NEMA WD-5; Specific-Purpose Wiring Devices.
 - NEMA SSL 7A; Phase-Cut Dimming for Solid State Lighting
 - 2. Underwriter's Laboratories (UL):
 - UL 20 General-Use Snap Switches.
 - UL 231; Power Outlets.
 - UL 310; Electrical Quick-Connect Terminals.
 - UL 498; Attachment Plugs and Receptacles.
 - UL 514A; Metallic Outlet Boxes.
 - UL 514D; Cover Plates for Flush-Mounted Wiring Devices.

UL 943; Ground-Fault Circuit-Interruption.
UL 1681; Wiring Device Configurations.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Provide color finishes for Architect to select from.
 - 4. Submit Manufacturer's installation instructions.
- B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 260553: Electrical Identification.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.05 WARRANTY

- A. Occupancy sensors offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Switches, receptacles and coverplates:
 - a. Pass & Seymour.
 - b. Hubbell.
 - c. Leviton.
 - 2. Occupancy/vacancy sensors switches, time switches:
 - a. SensorSwitch, Inc.
 - b. Wattstopper
 - c. Cooper Controls "Greengate"
 - d. Leviton

e. Hubbell Building Automation, Inc.

3. Floor mounted service boxes:

a. Legrand

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 WALL SWITCHES

A. Standards: Provide general-purpose 120/277volt AC switches that conform to NEMA WD-1 Specifications.

B. Color: Device color shall be as selected by the Architect, unless otherwise noted.

C. Wall switches:

1. Provide twenty amperes, 120/277volt, Specification grade, toggle handle, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.
2. Single-pole, single-throw switches: Hubbell #1221 series, Pass & Seymour #20AC1 series or Leviton #1221 series.
3. Three-way switches: Hubbell #1223 series, Pass & Seymour #20AC3 series or Leviton #1223 series.

2.03 OCCUPANCY/VACANCY SENSOR SWITCHES

A. Occupancy sensors: automatic on, automatic off.

B. Vacancy sensors: manual on, automatic off.

C. General:

1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.
2. Sensors shall be dual-technology type infrared/ultrasonic or infrared/microphonic or as specified herein.
3. Neutral connection required. Sensors that rely on ground leakage current for operation shall not be provided.
4. All sensors shall have an adjustable time delay off setting and a sensitivity adjustment.
5. Ceiling mounted sensors shall operate be line voltage or low voltage with separate control unit. Control unit shall contain power supply and relays for switching loads.
6. Units shall be furnished with area coverage to suit application. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.

D. Color: Device color shall be as selected by Architect, unless otherwise noted.

E. Wallbox mounted single level control sensors:

1. Sensor shall provide minimum coverage of 900-square feet.

2. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 4-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
 3. Load capacity of 0 to 1800watts at connected voltage.
 4. For use in small utility closets and similar areas where dual level switching is not indicated.
- F. Wallbox mounted dual level control sensors:
1. Sensor shall provide dual level switching capability and minimum coverage of 1000-square feet.
 2. Operation shall be manual (in two levels) "ON" and manual (in two levels) or automatic (full) "OFF".
 3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 20-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
 4. Load capacity of 50 to 1000watts at connected voltages.
 5. Integral photocell. Provide with ambient light control adjustment.
 6. For use in offices and similar areas where dual level switching is indicated.
- G. Wallbox mounted combination sensor and dimmer:
1. Sensor shall provide 0-10volt dimming capability for LED loads.
 2. Sensor shall provide minimum coverage of 20-feet for clear line-of-sight applications.
 3. Infrared only or dual-technology sensor.
 4. Time delay adjustment from 3-minutes to 20-minutes. Set initial time-out setting at 15-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
 5. For use in private offices and similar areas where dimming is indicated.
- H. Ceiling or wall mounted single-directional sensors:
1. Sensor shall provide minimum coverage of 900-square feet.
 2. Operation shall be automatic "ON" and automatic "OFF". Provide with a manual override switch.
 3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
 4. Load capacity of 20amps per power or slave pack at connected voltage.
 5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up 2 sensors and mounted inside standard 4-inch square box.
 6. For use in small office, classroom, and similar areas.
- I. Ceiling mounted omnidirectional sensors:
1. Sensor shall provide minimum omnidirectional coverage of 1000-square feet.
 2. Operation shall be automatic "ON" and automatic "OFF". Provide with a manual override switch.

3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
4. Load capacity of 20amps per power or slave pack at connected voltage.
5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up to 2 sensors and mounted inside standard 4-inch square box.
6. For use in large storage rooms and similar areas.

2.04 TIME SWITCHES

- A. Wallbox mounted, line voltage type.
- B. Shall be compatible with all LED lighting loads, electronic ballasts, motor loads, and inductive loads. Triac and other harmonic generating devices shall not be allowed.
- C. Shall have no minimum load requirement and shall be capable of controlling up to 800watts.
- D. Shall allow manual override of the preset time-out period.
- E. Time switch shall be capable of operating as an "ON/OFF" switch.
- F. Digital time switch:
 1. Shall have the option for a beep warning that shall sound every 5-seconds once the time switch countdown reaches one minute.
 2. Shall have an electroluminescent backlit Liquid Crystal Display that shows the timer's countdown.
 3. Maximum setting of 30-minutes for server aisles and 10-minutes for closets.
- G. Analog time switch:
 1. Spring wound rotary style.
 2. Maximum setting of 30-minutes for server aisles and 10-minutes for closets.
- H. Astronomical time switch:
 1. Includes integral programming function for precise Time Zone, Longitude, and Latitude input/
 2. Weekly schedule format.
 3. Minimum 5 programmable schedules.

2.05 RECEPTACLES

- A. Standards:
 1. Provide general purpose 20amp, 125/250volt AC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
 2. Provide NEMA 5-20R, industrial (heavy-duty) specification grade as noted herein, 20amp, 125volt AC, 2-pole, 3-wire grounding type receptacles.
 3. Receptacles shall be the standard conventional style device.
 4. Receptacles shall be tamper-resistant to meet the requirements of CEC Article 406.12.

- B. Color:
 - 1. Device color shall be as selected by the Architect, unless otherwise noted.
 - 2. Devices connected to an emergency circuit shall be red.
- C. General purpose single outlets:
 - 1. Provide self-grounding back and side wired with binding head staked terminal screw.
 - 2. Use Hubbell #5361 series, Pass & Seymour #5361 series Leviton #5361 series.
- D. General purpose duplex receptacles:
 - 1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
 - 2. Use Hubbell #5362 series, Pass & Seymour #5362 series or Leviton #5362 series.
- E. Ground fault circuit interrupting (GFCI) receptacles:
 - 1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5-milli-amp line-to-ground fault current in approximately 1/40th of a second.
 - 2. Provide visual device with trip indication, manual reset, and test mechanisms and with point of use and multi-outlet protection.
 - 3. Provide self-test and monitor feature with visual indicators on device face representing power status, trip condition, ground fault condition and end of life status.
 - 4. Provide weather resistant devices at all damp and wet locations.
 - 5. Use Pass & Seymour #2097TR series, Hubbell GFTRST20 series, Leviton #S7899 series, for Specification grade GFCI receptacles.
 - 6. Use Pass & Seymour #2097TRWR series, Hubbell GFTWRST20 series, Leviton #WT899 series for weather resistant GFCI receptacles.
- F. Controlled Receptacles:
 - 1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device permanently marked with universal symbol for controlled receptacle, and the word "CONTROLLED".
 - 2. Controlled duplex receptacles shall include split circuit hot tab for one controlled outlet, and one uncontrolled.
 - 3. Controlled double duplex receptacle shall consist of one uncontrolled general-purpose duplex receptacle, and one controlled duplex receptacle.
 - 4. For half controlled receptacle with split-circuit hot tab, use Pass & Seymour #5362CH, Hubbell BR20C1, or Leviton 5362-1P.
 - 5. For dual controlled receptacle, use Pass & Seymour #5362CD, Hubbell BR20C2, or Leviton 5362-2P.
- G. USB Charger Type Duplex Receptacles

1. Provide 20amp, 125volt AC, tamper-resistant specification grade receptacles consisting of NEMA 5-20R duplex device with two 5volt DC USB Type A charging ports; compatible with USB 2.0 and 3.0 devices, and capable of charging two devices simultaneously while still using receptacles.
 2. Comply with USB battery charging spec USB BC1.2
 3. Minimum 3.1 amps total charging capacity.
 4. Use Pass & Seymour TR5362USB series, Hubbell USB20X2 series, Leviton #T5832 series, for USB charger type duplex receptacles.
- H. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

2.06 FLOOR MOUNTED SERVICE BOXES

A. Multi-service recessed floor box:

1. Combination power and communication cable service floor box with flush cover and recessed compartment for access to service device(s). Box shall be for installation concrete floors.
2. Box shall be constructed of formed steel with provisions for adjustments before and after pour. Access hatch shall be steel and provided with carpet trim and insert. Make allowances for floor finishes if other than carpet. Furnish with specified receptacle(s) and accessories called for on Drawings.
3. Use Hubbell #3SFB-SS series or Walker 'Resource RFB' series.

B. Cast flush floor box:

1. Single or multi-gang floor box for flush applications in concrete floor. Box shall be cast iron with brass coverplates and carpet flange. Furnish with provisions for adjustments before and after pour. Provide with all accessories such as receptacles, compartment dividers, coverplate options, rings, etc. as indicated for application on Drawings.
2. Furnish box in either shallow or deep sizes as determined by the concrete floor depth and in ganged configurations indicated on Drawings.
3. Use Hubbell #B-2400, B-4200 and B-4300 series or Walker #880C series.

C. Poke-through floor fitting:

1. Flush style fire rated poke-through device for installation in a 2" or 3" cured hole through a concrete floor. Provide with finish ring, receptacle, cable access, box, etc. or any other accessories to facilitate the installation indicated on Drawings.
2. Use raceway components #RC 700 series or Walker #1500 series for flush installations.
3. Use raceway components #FIT-200 series or Walker #1600 series for monument installation.

2.07 COVERPLATES

A. General:

1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.

3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
 4. Provide plates of one design, standard conventional designer decora style, throughout the Project unless otherwise specified.
- B. Color: Coverplate color shall be ivory white black gray as specified by the Architect, unless otherwise noted.
- C. Plastic coverplates:
1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
 2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.
- D. Metal coverplates:
1. Provide smooth, type 430 stainless steel coverplates, 0.035" thick with rounded edges and corners.
 2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.
 3. Provide removable plastic film to protect coverplates during installation. Remove film at time of final acceptance.
- E. Weatherproof coverplates:
1. Non-public areas:
 - a. Provide horizontal mounted, weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
 - b. Furnish base plates, covers, hinge pins, spring, and screws of corrosion resistant type 302 stainless steel.
 2. Public area receptacles:
 - a. Provide horizontal mounted weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, lockable, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
 - b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
 - c. Provide two (2) keys for each locking type coverplate.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.
- B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.03 INSTALLATION

- A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.
- C. Mount switches at 42 inches to center above finished floor unless otherwise noted.
- D. Mount receptacles vertically with the centerline 18-inches above finished floor and with grounding slot at bottom.
- E. Mount receptacles vertically/horizontally when mounting above counters, mount with grounding slot to the left.
- F. Mount GFCI receptacles in the following locations, whether indicated as GFCI type or not on the drawings:
 - 1. In bathrooms.
 - 2. Where receptacles are installed within 6'0" from edge of sinks.
 - 3. In kitchens above counters.
 - 4. On rooftops.
 - 5. Outdoors.
 - 6. Where serving vending machines.
 - 7. Where serving electric drinking fountains.
- G. Derate ganged dimmer switches as instructed by Manufacturer. Do not use common neutrals in dimmer circuits.
- H. Install red receptacles where connected to an emergency circuit.
- I. Provide coverplates for all outlet boxes, switches, receptacles, etc.
- J. Install blank coverplates on all outlet boxes in which no device is required or installed.
- K. Provide coverplates that completely cover wall opening and seat against wall.
- L. Provide stainless steel coverplates for all devices in kitchen/food service equipment areas.

3.04 OCCUPANCY/VACANCY WALLBOX SENSORS

- A. All occupancy/vacancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.
- B. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to values as indicated in Part 2 above.
- C. Install wall mounted devices with the vertical centerline plumb and alleges of device flush against adjacent wall surfaces. Mount devices at 42-inches to center above finished floor unless otherwise noted.

3.05 FLOOR MOUNTED SERVICE BOXES

- A. Installation:
 - 1. Install floor boxes to be level or within 1/16" below screed line.
 - 2. Make conduit connections and anchor box to sub-flooring.
 - 3. Core drill hole in floor (core sized based on Manufacturer's installation instructions) for insert of poke-through device.
 - 4. Make conduit connection to poke-through box from floor below.
- B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.06 FIELD QUALITY CONTROL

- A. Electrical testing:
 - 1. Test proper polarity of all receptacles.
 - 2. Test ground continuity of all wiring devices.
 - 3. Test ground fault interrupting device operation.
- B. Visual and mechanical inspection:
 - 1. Check proper operation of all switches.
 - 2. Check indicating lights on all SPD receptacles.
 - 3. Visually inspect and replace damaged or defective devices.

3.07 CLEANING

- A. Clean interior of all boxes from dirt and paint prior to installation of devices.
- B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION

SECTION 26 28 16
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Fuses.
 2. Molded case circuit breakers.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. Underwriters Laboratories, Inc. (UL):
 - UL 248(1-16); Low-Voltage Fuses.
 - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - UL 512; Fuseholders.
 2. National Electrical Manufacturer Association (NEMA):
 - NEMA AB 1; Molded Case Circuit Breakers.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Describe product operation, equipment and dimensions and indicate features of each component.
 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
 5. Provide current let-through and melting time information for each type and rating of fuses.

6. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.
7. Submit Manufacturer's installation instructions.
8. Complete bill of material listing all components.
9. Warranty.

1.04 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. A detailed explanation of the operation of the system.
 2. Instructions for routine maintenance.
 3. Parts list and part numbers.
 4. Telephone numbers for authorized parts and service distributors.
 5. Final testing reports.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

- A. Units and components offered under this Section shall be covered by a **1**-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Fuses:
 - a. Bussmann Division, Cooper Industries.
 - b. Gould Shawmut Co.
 2. Circuit breakers:
 - a. Square D.
 - b. ABB/ General Electric.
 - c. Eaton.
 - d. Siemens.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.
- 2.02 GENERAL
- A. Overcurrent protective devices shall satisfy all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, 708).
 - B. Fuses rated 1200 amps or higher shall satisfy CEC Article 240.67 requirements.
 - C. Circuit breakers rated (or can be adjusted) 1200amps or higher shall satisfy CEC Article 240.87 requirements.
- 2.03 FUSES
- A. General: All power fuses shall be time-delay, high interrupting (300K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratio. Types of fuses shall be as follows:
 1. 0 to 600amps: UL Class J, dual element, time delay type fuse with separate overload and short-circuit elements. The fuse shall hold 500% of rated current for a minimum of 10-seconds.
 - B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.
- 2.04 MOLDED CASE CIRCUIT BREAKERS
- A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.
 - B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.
 - C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 14,000 RMS symmetrical amps for 480volt systems and 10,000 RMS symmetrical amps for 208volt systems.
 - D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.
 - E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

- F. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.
- G. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.
- H. All terminals shall be dual rated for aluminum or copper wire.
- I. Circuit breakers with frame ratings 100amps and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100amps shall be installed in distribution type panels.
- J. Circuit breakers with frame ratings above 100amps through 400amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.
- K. Circuit breakers with frame ratings above 400amps through 2500amps shall have microprocessor-based RMS sensing trip units with the following characteristics:
 - 1. Interchangeable current rating plug or an adjustable trip setting to match the trip rating as indicated on Drawings.
 - 2. Adjustable long-time pick-up setting. Minimum of five settings from 50% to 100%.
 - 3. Adjustable long-time delay setting. Minimum of three delay bands.
 - 4. Adjustable short time pick-up setting. Minimum of five settings from 200% to 800%.
 - 5. Adjustable short-time delay setting. Minimum of three delay bands with I2t IN and OUT curves.
 - 6. Adjustable instantaneous pick-up setting. Minimum of five settings from 200% to 1000%. Where the instantaneous feature is omitted on the Drawings, the trip unit shall have an instantaneous override feature.
 - 7. Zone selective interlocking (ZSI) for short-time delay and ground-fault delay trip functions, if indicated on the drawings.
 - 8. LED status indication to show "health" of trip unit.
 - 9. Three-phase ammeter, if indicated on the drawings.
 - 10. Trip indication targets on overload, ground fault and short circuit, if indicated on the drawings.
- L. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.
- M. Spaces in the boards shall be able to accept any combination of 1, 2 or 3-pole circuit breakers as indicated. Provide all necessary bus, device supports, and mounting hardware sized for frame, not trip rating.
- N. Series rated breakers are not acceptable unless specifically noted on the Drawings.
- O. Breaker shall be rated to operate in an ambient temperature of 40-degrees C and at 100% of their frame ampere rating on a continuous basis, if indicated on the drawings.

- P. For circuit breakers rated or can be adjusted to 1200amps (or higher), provide zone selective interlocking (ZSI) with downstream protective devices, if indicated on the drawings. If ZSI is not indicated on the drawings, provide a key interlock maintenance mode switch and blue LED indicating lamp in the same section, which shall allow an operator to manually enable temporary protective device maintenance settings to reduce the arc flash energy level. Key shall be held captive when maintenance mode signal is disabled and removable when maintenance mode signal is enabled. Maintenance mode switch positions shall be labeled "Enabled" and "Disabled". Blue indicating lamp shall be push-to-test type.
- Q. Refer to the Drawings for breakers requiring ground fault protection. See Section 262413: Switchboards for requirements of ground fault protection system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.
- C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.
- D. Circuit breakers serving "Fire Alarm Control Panel(s)" shall be red in color.

3.03 ATTIC STOCK

- A. Provide 1 set of spare fuses for every set installed.

3.04 FIELD QUALITY CONTROL

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
 - 1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 - 3. Prepare final test report including results, observations, failures, adjustments, and remedies.
 - 4. Verify ratings and settings and make final adjustments.

- B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.
- D. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.
- E. Prefunctional testing:
 - 1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 - 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers, and doors are secure.
 - 3. Electrical tests:
 - a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
 - b. Test all circuit breakers with frame size 225amps and larger in each panelboard, distribution board, switchboard, etc. unless otherwise noted via primary current injection testing. Testing shall verify the following:
 - 1) Determine that circuit breaker will trip under overcurrent conditions, with tripping time in conformance with NEMA AB 1 requirements.
 - 2) Circuit breaker pickup and delay measurements are within the manufacturers published tolerances for long time, short time, instantaneous, and ground fault.
 - 3) For circuit breakers rated or can be adjusted to 1200amps (or higher), confirm ZSI protection is acceptable or the maintenance mode switch is operational (enabled and disabled) with reduced pickup and delay measurements when enabled.
- F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.05 ADJUSTING

- A. Adjust circuit breaker trip settings based on recommendations of Section 260060: Power System Study.

- B. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.
- C. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.

3.06 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

3.07 TRAINING

- A. Factory authorized service representative shall conduct a 4-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.
- B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 26 28 19
DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Disconnect Switches.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated on specified:
 - 1. National Electrical Manufacturer Association (NEMA):
 - NEMA KS 1; Enclosed Switches.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 512; Fuseholders.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. As a minimum the following characteristics shall be indicated:
 - a. NEMA types.
 - b. Current rating.
 - c. Number of poles.
 - d. Fuse provisions.
 - e. Enclosure dimensions.
 - f. Voltage.
 - g. Horsepower rating (if applicable).
 - h. Short circuit rating.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Square D.
 - 2. ABB/ General Electric.
 - 3. Eaton.
 - 4. Siemens.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 DISCONNECT SWITCHES

- A. Description: Provide NEMA heavy-duty type switches with dead front construction and padlock provisions for up to three locks in the "OFF" position.
- B. Switch interior: Provide switch with switchblades that are fully visible in the "OFF" position when the door is open. Provide UL listed lugs for copper conductors, lugs to be front removable. Provide plated current carrying part.
- C. Switch mechanism: Provide switches with a quick-make, quick-break, position indicating, operating handle and mechanism and a dual cover interlock to prevent unauthorized opening of the switch door in the "ON" position or closing of the switch mechanism with the door open. Furnish an electrical interlock to de-energize control wiring when the disconnect switch is opened.
- D. Enclosures: Provide switches with hinged cover in NEMA 1 general purpose, sheet steel enclosure for dry locations and NEMA 3R weatherproof galvanized enclosures for exterior, damp, or wet locations, unless otherwise noted on the Drawings. Provide an enclosure treated with a rust-inhibiting phosphate primer and finished in gray baked enamel.
- E. Ratings: Provide switches that are horsepower rated for 240 VAC or 600volt AC as required for the circuit involved and that meet "I-SQUARED-T" requirements. Fusible switches to have provisions for the types of fuses specified in Section 262816: Overcurrent Protective Devices. UL listed short circuit rating, when equipped with fuses to be 200,000amps RMS symmetrical. Furnish with provisions for RK-1 fuses for switches up to 600amps. 800amp switches and larger to have provisions for Class L fuses.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Contractor shall thoroughly examine Project site conditions for acceptance of disconnects switch installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to ensure that switches are insight of the controller as described in CEC Article 430.

3.03 INSTALLATION

- A. Install disconnect switches where indicated on the Drawings.
- B. Install fuses in fusible disconnect switches.
- C. Include construction channel and mounting hardware as required to support disconnect switch.

3.04 IDENTIFICATION

- A. Provide engraved, machine screw retained type 'NP' nameplate on each disconnect switch. See Section 260553: Electrical Identification.

3.05 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of enclosure of all construction debris, scrap wire, paint splatters, dirt, etc.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTIVE DEVICES (SPD)

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Surge protective devices (SPD).
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
1. American National Standards Institute, Inc. (ANSI)/Institute of Electrical and Electronics Engineers (IEEE):
 - ANSI/IEEE C62.1; Standard for Surge Arresters for Alternating Current Power Circuits.
 - ANSI/IEEE C62.11; Standard for Metal-Oxide Surge Arrestors for AC Power Circuits.
 - ANSI/IEEE C62.41.1; Guide on the Surges Environment in Low-Voltage (1000V and Less) AC Power Circuits.
 - ANSI/IEEE C62.41.2; Recommended Practices on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits.
 - ANSI/IEEE C62.45; Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
 2. Underwriters Laboratory, Inc. (UL):
 - UL 50; Cabinets and Boxes.
 - UL 1283 Electromagnetic Interference Filters. [Type 2 only]
 - UL 1449; Surge Protective Devices, 4th Edition.
 3. National Electrical Manufacturers Association (NEMA):
 - NEMA PB 1.1; General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

1.03 SYSTEM DESCRIPTION

- A. Provide surge protective device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchboards, and panelboards.

- B. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 4th Edition).
- C. SPD units shall be furnished in two Types. Type 1 and Type 2 as outlined below:
 - 1. Type 1: Permanently connected SPDs installed on the line or load side of main disconnect device(s), at main switchboard. This type closely relates to the devices previously referred to as secondary surge arrestors. These Type 1 SPDs should be specially suited to conduct the high energy impulses from lightning strikes.
 - 2. Type 2: Permanently connected SPD installed on the load side of the service panel main disconnect device(s). This type most closely relates to devices that were previously classified as Transient Voltage Surge Suppression (TVSS). These Type 2 SPDs are especially suited for distribution boards and panelboard applications.

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe system operation, equipment and dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Shop Drawings: Include elevations, cabinet dimensions, complete component listing and layout within cabinet, amperage ratings and capacities, system characteristics and wiring diagrams.
 - 5. Submit Manufacturer's installation instructions.
 - 6. Complete bill of material listing all components.
 - 7. Warranty.

1.05 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following.
 - 1. A detailed explanation of the operation of the system.
 - 2. Instruments for routine maintenance.
 - 3. Pictorial parts list and parts number.
 - 4. Telephone numbers for authorized parts and service distributors.

1.06 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: SPD components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with the Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.08 WARRANTY

- A. Units and components offered under this Section shall be covered by a **5**-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Schneider Electric/ Square D.
 - 2. ABB/ General Electric.
 - 3. Eaton.
 - 4. Siemens.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

- A. All Specification noted herein apply to the switchboard, and panelboard units, unless otherwise noted.
- B. The SPD system utilizes diversion modules to suppress and divert transient voltage and surge currents. The system is designed to provide protection for sensitive electronic devices against the effects of surges, transients, and electrical line noise.
- C. Environmental requirements:
 - 1. Operating temperature: -40-degree C to 60-degree C.
 - 2. Relative humidity: 0% to 95%.
 - 3. Operating altitude: 0 to 12,000-feet.
 - 4. Audible noise: Less than 35-dB.
- D. Electrical requirements:
 - 1. Unit operating voltage: The SPD system voltage shall be as indicated on the Drawings.

2. Maximum continuous operating voltage “MCOV”: The MVOC shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors “MOVs” as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection modes: The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

PROTECTION MODES TABLE				
Configuration	L-N	L-G	L-L	N-G
WYE	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal discharge current (In): All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an in less than 20kA shall be rejected.
6. Voltage protection rating (VPR): The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

VOLTAGE PROTECTION RATING TABLE				
System Voltage	L-N	L-G	L-L	N-G
120/208	700V	700V	1200V	700V
277/480	1200V	1200V	2000V	1200V
346/600	1500V	1500V	3000V	1500V

E. SPD design:

1. The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
3. Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50-dB from 10kHz to 100MHz using the MIL-STD-220A insertion loss test method.
4. No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. SPD shall provide the following integral monitoring options:

- a. Each unit shall have a green/red solid-state indicator light that reports the status of the protection on each phase:
 - 1) For WYE configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. WYE configured units shall also contain an additional green/red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode.
 - 2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
 - 3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators shall indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights shall continue to indicate the status of the protection on all other phases and protection modes.
- b. The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
- c. The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
- d. Surge counter:
 - 1) The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.
 - 2) The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50amps \pm 20amps occurs.
 - 3) A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2-seconds in order to clear the surge count total.
 - 4) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.
6. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. All the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety requirements:

- a. The SPD shall minimize potential arc flash hazards by containing no user serviceable or replaceable parts and shall be maintenance free. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.03 SYSTEM APPLICATION

- A. The SPD applications covered under this section include switchboards panelboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

MINIMUM SURGE CURRENT CAPACITY TABLE			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards)	250kA	125kA
B	High Exposure Roof Top Locations (Switchboards and Panelboards)	160kA	80kA
A	Branch Locations (Panelboards)	120kA	60kA

- C. All SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.04 PANELBOARDS

- A. The SPD application covered under this section includes lighting and outlet panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category A or B environments.
- B. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
- C. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
- D. The panelboard shall be capable of re-energizing upon removal of the SPD.
- E. The SPD shall be interfaced to the panelboard via a direct bus bar connection.
- F. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
- G. The SPD shall be of the same manufacturer as the panelboard.
- H. The complete panelboard including the SPD shall be UL67 listed.

2.05 SWITCHBOARDS

- A. The SPD application covered under this section is for switchboard locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

- B. The SPD shall be of the same manufacturer as the switchboard.
- C. The SPD shall be factory installed inside the switchboard at the assembly point by the original equipment manufacturer.
- D. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
- E. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
- F. The SPD shall be integral to switchboard as a factory standardized design.
- G. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.06 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
 - 1. NEMA 1: Constructed of a polymer (units integrated within electrical assemblies), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
 - 2. NEMA 4: Constructed of steel, intended for either indoor or outdoor use, to provide a degree of protection from the following:
 - a. Against access to hazardous parts.
 - b. Of equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust).
 - c. With respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water).

2.07 SOURCE QUALITY CONTROL

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of SPD installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. Install SPD in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. As a minimum, provide SPDs on all service entrance switchboards, 120/208volt distribution switchboards and 120/208volt panelboards in compliance with CEC Article(s) 285, 620, 645, 670, 695, and 700.

- C. Conductors from the power source to the SPD shall be minimum #4 AWG copper in switchboards and #8 AWG copper in panelboards (when not direct bus connected). Conductors shall be routed without sharp bends and straight and short as possible. The absolute maximum of 7'-0" long for units in switchboards and 1'-0" long for units in panelboards.
- D. Conductors originating from direct bus bar connections shall be individually wrapped with electric tape in half-lapped increments for added protection of the un-protected conductors. Tie-wrap the conductors away from the bus bars without any sharp bends. All holes that the conductors pass through shall be grommets.
- E. Cabinets shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

3.03 ATTIC STOCK

- A. For every SPD installed in panelboard or switchboard, a replacement SPD shall be provided for attic stock.

3.04 FIELD QUALITY CONTROL

- A. Prefunctional testing:
 - 1. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects, alignment, and fit.
 - b. Compare nameplate information and connections to Contract Documents.
 - c. Check tightness of all control and power connections.
 - d. Prior to energization, verify source neutral is bonded to ground per CEC Articles 250.24(B), 250.28 and 250.30.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Interior luminaires (lighting fixtures.)
 - 2. Exterior luminaires.
 - 3. Light-emitting diode (LED) assemblies.
 - 4. Drivers and transformers.
 - 5. Optical components; including diffusers, refractors, reflectors, and louvers.
 - 6. Poles and brackets.
 - 7. Unit battery equipment.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 03: Concrete; for cast-in place bases for lighting poles and bollards.
 - 3. Division 05: Metals; for fittings, brackets, backing supports, rods, etc. as required for support and bracing of luminaires.
 - 4. Division 09: Finishes; for ceilings, wall assemblies, acoustical treatment, and field painting of luminaires.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and Standards except as otherwise indicated or specified:
 - 1. American National Standards Institute (ANSI):
 - ANSI/IEC 60529; American National Standard for Degrees of Protection Provided by Enclosures (IP Code)
 - C137.0 Lighting System Terms and Definitions.
 - C137.1 0-10V Dimming Interface for LED Drivers and Controls
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 66; Fixture Wire.
 - UL 102.3; Standard Method of Fire Test of Light Diffusers and Lenses.
 - UL 844; Luminaires for Use in Hazardous (Classified) Locations.

- | | |
|------------|--|
| UL 924; | Emergency Lighting and Power Equipment. |
| UL924a; | Auxiliary Power Supplies (for generator-backed systems.) |
| UL 1574; | Track Lighting Systems. |
| UL 1598; | Luminaires. |
| UL 1598C; | Light-Emitting Diode Retrofit Luminaire Conversion Kits. |
| UL 1838; | Low Voltage Landscape Lighting Systems. |
| UL 1993; | Self-Ballasted Lamps and Lamp Adapters. |
| UL 2007A; | Shatter Containment of Lamps for Use in Regulated Food Establishments. |
| UL 2108; | Low Voltage Lighting Systems. |
| UL 2592; | Low Voltage LED Wire. |
| UL 5085-3; | Low Voltage Transformers: Class 2. |
| UL 8750; | Light Emitting Diode (LED) Equipment for Use in Lighting Products. |
| UL 8753; | Field-Replaceable Light Emitting Diode (LED) Light Engines. |
| UL 8754; | Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays. |
3. National Electrical Manufacturers Associations (NEMA):
- | | |
|--------|--|
| SSL-1; | Electronic Drivers for LED Devices, Arrays or Systems. |
| SSL-4; | Retrofit Lamps—Minimum Performance Requirements. |
| 77; | Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria. |
| LE-4; | Recessed Luminaires, Ceiling Compatibility |
| 100; | Wire Insulation Colors for Lighting Systems |
4. Illuminating Engineering Society of North America (IESNA):
- | | |
|---------------|--|
| TM-15; | Luminaire Classification System for Outdoor Luminaires. |
| TM-21; | Projecting Long Term Lumen Maintenance of LED Light Sources. |
| TM-30; | Method for Evaluating Light Source Color Rendition. |
| TM-30-Annex E | Recommendations for Specifying Light Source Color Rendition |
| LM-79; | Electrical and Photometric Measurements of Solid-State Lighting Products. |
| LM-80; | Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules. |
| LM-84; | Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires. |
| LM-86; | Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components |

5. Restriction of Hazardous Substances (RoHS):

RoHS 3; Directive 2015/863 - Cat 5. Lighting: lamps, luminaires, light bulbs.

1.03 SYSTEM DESCRIPTION

- A. Provide and install a fully functional and operating lighting system as indicated, complete with light engines, lamps, wiring, and securely attached to support system to meet all seismic code requirements.
- B. Where catalog number and narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

1.04 SUBSTITUTIONS

- A. Refer to Section 260010: Basic Electrical Requirements for specific Equipment requirements.
- B. Items specified under this Section and Luminaire Schedule are subject to the requirements, with the following qualifications:
 - 1. Items solely specified by Manufacturer name and catalog number, without qualifiers: Provide as specified – No Substitutions.
 - 2. Items specified by multiple Manufacturers, without qualifiers: Provide any listed manufacturer – No Substitutions.
 - 3. Items specified by sole or multiple Manufacturers, followed by “Or Approved Equal” or “Or Approved Equivalent”: Conform to substitution requirements outlined for Equipment.
 - 4. Items specified by sole or multiple Manufacturers, followed by “Or Equal” or “Or Equivalent”:
Products that meet the salient requirements are acceptable to provide.
 - a. Equivalency is at the sole judgement of the Architect and Engineer.
 - b. Should a submitted, unspecified product fail to meet the requirements of Equivalency, provide specified products at no additional cost to the Owner.
- C. Equivalency shall be determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on any characteristic shall constitute justification for rejection of the submittal or substitution.
 - 1. Performance:
 - a. Distribution.
 - b. Utilization.
 - c. Luminance distribution (Average brightness / maximum brightness.)
 - d. Spacing to mounting height ratio.
 - e. Overall luminaire efficiency.
 - 2. Construction:
 - a. Engineering.
 - b. Workmanship.
 - c. Rigidity.
 - d. Permanence of materials and finishes.

3. Installation Ease:
 - a. Captive parts and captive hardware.
 - b. Provision for leveling.
 - c. Through-wiring ease.
4. Maintenance:
 - a. Ease of relamping / replacement of LED array.
 - b. Ease of replacement of driver/ballast and lamp sockets.
5. Appearance:
 - a. Architectural integration.
 - b. Light tightness.
 - c. Styling.
 - d. Conformance with design intent.
 - e. When requested, furnish a working sample complete with housing, trim, 8' cord and plug, and specified lamp.

1.05 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 1. Complete bill of material listing (index) of all luminaires. Index shall be organized in the same sequence as the Luminaire Schedule (alphabetical.) Include in the index:
 - a. Type per the Luminaire Schedule.
 - b. Manufacturer.
 - c. Complete catalog number, including all accessories and appurtenances required for the installation.
 - d. Voltage.
 - e. Poles, arms, and brackets, if applicable.
 - f. Lamping, if applicable.
 2. Manufacturer's data sheets/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - a. Identify luminaire type on each sheet.
 - b. Clearly mark on each data sheet the specific item(s) being submitted. Obfuscate or otherwise delete options on data sheets that are not provided.
 3. Driver or transformer and/or lamp data sheets as applicable to submitted item.
 4. Manufacturer's installation instructions.
 5. Warranty.
 6. U.L. labeling information.

7. Photometric Reports consisting of:
 - a. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for luminaires with asymmetric distributions and luminance data for vertical angles above 45 degrees from nadir.
 - b. Coefficient of utilization table.
 - c. Zonal lumen summary including overall luminaire efficiency.
8. Shop Drawings:
 - a. Where noted in the Luminaire Schedule, submit Shop Drawings from Manufacturer detailing modified or custom luminaires indicating dimensions, weights, methods of field assembly, components, features, accessories, methods of support, etc.
9. Mock-ups: Provide mock-up luminaire samples where "MOCK-UP" is indicated in the Luminaire Schedule. Refer to Part 3 – Execution for requirements.

1.06 OPERATION AND MAINTENANCE MANUAL

- A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
 1. An updated index per 1.05-A.
 2. One complete set of final submittals of actual product installed, including product data and shop drawings.
 3. Instructions for routine maintenance.
 4. Pictorial parts list and parts number.
 5. Telephone numbers for authorized parts and service distributors.

1.07 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Luminaires shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.09 WARRANTY

- A. Units and components offered under this Section shall be covered by a **1**-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Luminaires, Poles, and Exit Signs: as listed in the Luminaire Schedule.
 2. Light-Emitting Diode (LED) Arrays:
 - a. Cree.
 - b. Nichia.
 - c. Citizen.
 - d. Lumileds.
 - e. Samsung.
 - f. Lumenetix Araya.
 - g. Xicato.
 - h. Bridgelux.
 - i. LEDs provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
 3. LED replacement and integral-driver lamps:
 - a. General Electric.
 - b. Osram.
 - c. Cree.
 - d. Maxlite.
 - e. Green Creative.
 - f. Soraa.
 4. LED drivers (DC output):
 - a. eldoLED.
 - b. Lutron.
 - c. Signify Advance.
 - d. Osram.
 - e. Q-Tran.
 - f. Universal Lighting Technologies.
 - g. Drivers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

5. Transformers for LED systems (AC output):
 - a. Q-Tran.
 - b. Hatch.
 - c. Semper Fi.
 - d. Transformers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
 6. Unit battery equipment:
 - a. Philips Bodine.
 - b. Myers/Iota.
 - c. Unit battery equipment provided by Luminaire Manufacturers listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

- A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.
- B. Luminaire assemblies U.L. listed appropriate to mounting conditions and application. All labels affixed to the luminaire shall be in a location not visible from normal viewing angles.
- C. Each luminaire family type (downlights, etc.) supplied by only one manufacturer.
- D. Recessed luminaires installed in fire rated ceilings and using a fire rated protective cover shall be thermally protected for this application and shall carry a fire rated listing.
- E. Luminaires installed under canopies, roofs or open areas and similar damp or wet locations shall be UL listed and labeled as suitable for damp or wet locations.
- F. Luminaires shall bear the IP rating appropriate for the application.
- G. Luminaires shall be free of light leaks and shall be designed to provide sufficient ventilation of light engines, including ventilation holes where required.

2.03 LUMINAIRE CONSTRUCTION

- A. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. 20-gauge (0.7-mm or 0.027-inch) minimum.
 1. Finish: Baked white dry polyester powder, unless otherwise specified, with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process prior to painting.
 2. Luminaire (including all painted component parts) shall be painted after fabrication unless specifically noted in the Luminaire Schedule.
- B. Extruded Aluminum Housings: One-piece housing of AA 6063 T5 extruded aluminum with 0.14 minimum thickness smooth and free of tooling lines in one uninterrupted section of 1-foot to 24-foot with the cross sectional dimensions as indicated in the Luminaire Schedule.
- C. Die-Cast Aluminum Housings:

1. Single-piece casting to ensure water tightness.
 2. Low copper (<0.7% Cu) aluminum alloy.
 3. Minimum Class 4 Consumer Grade per NADCA Standards.
- D. All surfaces shall be cleaned and dressed to eliminate all exposed sharp edges or burrs.
- E. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.
- F. End Plates: Die cast end plates shall be mechanically attached without exposed fasteners. End caps shall be minimum 0.125" thick.
- G. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.
- H. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.
- I. Fasteners shall be manufactured of galvanized steel.
- J. Adjustable Lamp Mechanisms: To have aiming stops which can be permanently set to position lamp vertically and rotationally.
- K. Recessed luminaires: Equip with through-wire junction box. Box, driver, and replaceable components shall be accessible from the ceiling opening of the luminaire.
- L. Finish:
1. All exposed aluminum surfaces shall be treated with an acid wash and clear water rinse prior to painting. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.
 2. All exposed steel surfaces shall be treated with an acid wash and clear water rinse, then prime coated. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.
- M. Door Frames for lensed luminaires: White painted, flat aluminum with mitered corners.

2.04 SUSPENSION

- A. Suspension Devices, type as specified in the Luminaire Schedule:
1. Aircraft Cable: Stainless steel type - 3/32" nominal diameter, stranded, with positive pressure, field adjustable clamp at luminaire connection.
 2. Rigid Pendant: 1/2" nominal diameter or as specifically shown on drawings. Supplied by luminaire manufacturer when available as standard product. At luminaire end of stems, provide earthquake type swivel fitting to permit 45-degree swing in any direction away from vertical.
 3. Chain hangers: Length to suit mounting height if shown or as field conditions dictate. Use two heavy duty chains with "S" hooks at each suspension point. Length to suit mounting height as shown on Drawings.
- B. Suspension system must permit ±13-mm (1/2") minimum vertical adjustment after installation.
- C. Supports:

1. Provide internal safety cable from luminaire body to stud in outlet box.
 2. Carry luminaire weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.
- D. Feed Point:
1. Flat-plate canopy to cover outlet box, with holes for support cable and power cord, concealed fasteners to permit splice inspection after installation.
 2. At the electrified connection provide straight cord feed.
 3. Power cord: white multi-conductor cord, parallel to support cable (aircraft cable); within pendant (rigid pendant); or flexible conduit (chain hanger).
 4. Where emergency feed is required, a separate feed point shall be provided.
- E. Non-feed Points:
1. 13-mm ($\frac{1}{2}$ ") O.D. polished chrome end sleeve, inside threaded $\frac{1}{4}$ "-20, with 50-mm (2") diameter. Flat white plate to cover hole in ceiling. Top of cable with ball swaged on end, to fit inside sleeve.
 2. Contractor to provide support above ceiling as required.
- F. Suspension method shall allow adjustment to be made in hanging length to allow for variance in ceiling height.
- G. All exposed paintable suspension components shall have the same finish and color as the luminaire housing.

2.05 LAMPHOLDERS

- A. Of configuration and design to accept standard lamp bases.
- B. Wiring channels and lampholder mountings shall be rigid and accurately constructed.
- C. Integral-driver LED:
 1. Medium screw base: Unglazed porcelain body or thermoplastic (PET GF) with copper-alloy screw shell. 660watt, 250volt rated.
 2. Bi-Pin base: Ceramic casing with mica cover plate, copper allow contact surfaces. Pin distance designed for lamp provided.

2.06 LED ARRAYS

- A. Minimum lumen maintenance per LM-80 measurements and TM-21 calculations: L90 at 60,000 hours.
- B. Maximum burnout: B90 at 200,000-hours.
- C. Free of mercury and toxic materials; RoHS compliant.
- D. Linear LED boards: LED pitch shall be consistent throughout the luminaire and shall remain consistent from the end of one board to the start of the next. LED pitch shall be the same from the endcap of the luminaire to the last LED on the board as the LED pitch throughout the luminaire. Luminaire shall have a continuous luminous appearance – bright or dark spots are not acceptable.
- E. White LEDs:

1. Interior
 - a. Correlated Color Temperature (CCT): 4000K
 - b. Minimum efficacy: 75 lumens per watt.
 - c. L70 lifetime: minimum 80,000-hours (extrapolated.)
 - d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 3-step MacAdam ellipse variation throughout listed life (L70).
 - e. Color Rendering Index (CRI); minimum 80 Ra.
 - f. R9 value; minimum 30.
 - g. TM30 values; $R_f > 75$, $92 > R_g > 110$.
 2. Exterior
 - a. Correlated Color Temperature (CCT): 4000K
 - b. Minimum efficacy: 100 lumens per watt.
 - c. L70 lifetime: minimum 100,000-hours (extrapolated.)
 - d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 4-step MacAdam ellipse variation throughout listed life (L70).
 - e. Color Rendering Index (CRI); minimum 70 Ra.
 - f. R9 value; minimum 20.
 - g. TM30 values; $R_f > 70$, $80 > R_g > 120$.
- F. Tunable White LEDs:
1. CCT range as specified in Luminaire Schedule.
 2. Color temperature at each "step" shall follow the Planckian Locus (Black Body Curve), +/- 50K.
 3. Color adjustment via separate 0-10volt input from driver.
 4. Submit Chromaticity curves for review.
- G. RGB Color LEDs:
1. As specified in Luminaire Schedule.
- 2.07 LED DRIVERS:
- A. LED drivers shall be integral to luminaire housing or remotely located, when specified, within 15 feet of diode assembly.
1. Luminaires shall be provided with the UL listed or equivalent driver and low voltage power supply as recommended by Manufacturer to insure proper and consistent lamp and luminaire performance. The number of LEDs per luminaire per power supply shall not be exceeded, and LEDs shall not be wired to a high capacity driver unless recommended by Manufacturer.
 2. Light Emitting Diode (LED) control gears shall operate with sustained variations of +/- 10% in voltage and frequency without damage to the driver and have a power factor not less than 90%. Regulations: +/-5% across the listed load range.

3. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%. The Driver shall have a Class A sound rating unless otherwise specified.
4. Control gear shall be rated for 50-degree C ambient temperature.
5. All control gear shall facilitate smooth, flicker-free dimming from 100% to 10%, 1% or 0.1% as noted on the Luminaire Schedule.

2.08 LENSES

A. Acrylic:

1. Lenses shall be extruded or injection molded crystal clear 100% virgin acrylic (except as indicated otherwise). For lenses with male pattern of pyramids or cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones) or thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material.
2. Lenses shall fully eliminate lamp images when viewed from all directions within 45 to 90-degree angles from vertical, where the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.50. Within the viewing angle from 0 to 45-degrees the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.
3. Finishes (i.e. sandblasting, etching, polishing) shall be performed as described in the Luminaire Schedule.
4. Plastic electrical light diffusers must meet the requirements of Section 2-5209, CAC, Flame Spread Rating.
5. Prismatic Acrylic:
 - a. Extruded of clear virgin acrylic plastic, 0.125" minimum overall thickness, 0.100" nominal unpenetrated thickness, Pattern 12 with flat sided female prisms running at 45 degrees off panel axis unless otherwise specified in the luminaire schedule. Concave prisms are not acceptable.
6. Opal acrylic:
 - a. Extruded or injection molded of virgin acrylic plastic, 0.080" minimum overall thickness.

2.09 REFLECTOR CONES

- A. Reflector cones shall be manufactured of uniform gauge, not less than 0.032" thick, high purity aluminum, Alcoa 3002 alloy, free of spin marks or other defects or blemishes caused during manufacturing.
- B. The finish on the inner surface of the reflector shall be as described in the Luminaire Schedule and as produced by the Alzak process. The reflector shall have an anodic coating of not less than four mils thick. The reflector inner surface shall be free of water spotting and shall maintain a reflectivity ratio of not less than 83% on clear specular finishes. The reflectors shall have a low iridescence finish.
- C. All luminaires using Alzak reflector cones shall be supplied by the same manufacturer unless directed otherwise in Luminaire Schedule.

- D. Provide 45-degree lamp and lamp imaging cut-off unless otherwise specified in the Luminaire Schedule. Where upper reflector is separated from cone, cut-off shall be 45-degrees unless otherwise noted.
- E. Plastic materials shall not be used for reflector cones or aperture plate materials.
- F. Luminaires in which reflector cones are riveted or welded to the housing or where removal of the cone requires pressure to be applied to the finished surface of the reflector shall not be acceptable.
- G. Cone flange shall be formed as an integral part of the cone and shall have identical color and finish as the cone, except when specified otherwise in the Luminaire Schedule. The flange major surface shall be perpendicular to the cone axis. The width of the flange shall adequately cover the ceiling opening without light leaks. No luminaire parts (housing, mounting frame, etc.) shall be visible between the ceiling surface and the edge of the cone flange.
- H. Reflector cone retention devices shall not deform the cone in any manner.

2.10 POLES

- A. Wind-load strength: 80 mph and 1.3 gust factor for total support assembly, including pole, base and anchorage, where used, to carry the combined Effective Projected Area (EPA) rating of the luminaire heads, arms, supports, and appurtenances at the indicated heights above grade without deflection or whipping.
- B. Pole shafts:
 - 1. Round straight, round tapered, square straight, or square tapered as noted on the Luminaire Schedule.
 - 2. Steel poles: Steel tubing conforming to ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psi. Single piece construction up to 40-feet in height.
- C. Arm, bracket and tenon mount materials: Finish to match poles.
- D. Mountings, fastenings, and appurtenances: Corrosion-resistant components compatible with the poles and luminaires that will not cause galvanic action at contact points. Provide mountings that will correctly position the luminaire to provide the indicated light distribution.
- E. Handhole: Provide handhole and cover near base of pole shaft for access to wiring compartment.
- F. Grounding lug: Provide grounding lug for grounding conductor with access through handhole.
- G. Pole bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts and bolt covers.
- H. Anchor bolt covers: Spun or two-piece gravity held unless otherwise specified.
- I. Pole-top tenons: Fabricated to support the luminaire indicated and securely fastened to the pole top.

2.11 LIGHTING TRANSFORMERS

- A. Low voltage transformers:
 - 1. Low voltage transformers shall be core and coil construction, unless otherwise noted.
 - 2. Primary voltage shall be as noted in Luminaire Schedule, secondary voltage 12volt AC, unless otherwise noted.

3. Sound rating shall be the best available. Replace excessively noisy transformers at no cost to the Owner.

2.12 UNIT BATTERY EQUIPMENT

A. LED Emergency Power Supplies

1. Standard Features:
 - a. Safety compliance to UL 924; CAN/CSAC22.2 No.141-10 and NFPA requirements for 90-minute egress
 - b. Open circuit / short circuit protection
 - c. Operating temperature: 32-degree F/0-degree C to 122-degree F/50-degree C
2. Test switch / charging indicator light
3. Emergency reaction time < 1-sec
4. Powder coat steel, stainless or galvan-nealed case
5. Field-replaceable NiCd battery pack (x2) with quick connect
6. Min. lead wire length: 6in UL 1452 solid / #18 AWG 1000volt / 90-degree C

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of luminaire installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Architectural Plans shall govern exact ceiling construction and mounting conditions for all luminaires. Locate as shown on the architectural elevations and reflected ceiling plan.
- B. Consult Architectural Drawings for details of ceiling construction, finish, and other applicable details.
- C. Contractor shall be responsible for coordination of luminaire mounting and compatibility with ceiling construction.
- D. Luminaires in areas where exposed or concealed pipe and ductwork prevents direct access to the structural ceiling shall be provided with appropriate support system to install luminaire below obstructions to avoid conflicts with same.

3.03 ARCHITECTURAL COORDINATION

- A. Where luminaires are mounted in architectural coves, soffits, valances, or cabinets and are given an overall length, the Contractor shall verify all lengths in the field prior to releasing order.
- B. Where luminaires are surface mounted or suspended to match the length of walls or other architectural elements, the Contractor shall verify all lengths in the field prior to releasing order.
- C. Mounting heights specified on drawings:
 1. Wall mounted luminaires: shall be to centerline of luminaire.
 2. Pendant mounted luminaires: shall be to bottom of luminaire unless specifically identified in the Luminaire Schedule or on drawings.

3.04 INSTALLATION

- A. Install luminaires in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Contractor shall be responsible for all supports, hangers, and hardware necessary for a complete installation.
- C. Luminaires shall be plumb, level, square, in straight lines and without distortion.
- D. Remedy light leaks that may develop after installation of recessed or enclosed luminaires.
- E. Adjustable luminaires shall be installed with "dead" zone of rotation away from intended aiming point.

3.05 LUMINAIRE SUPPORTS

- A. Physical (gravity) supports:
 - 1. Recessed luminaires in wood framed ceilings shall be supported by 2" x 4" hangers fastened to adjacent ceiling joists.
 - 2. Recessed downlights in wood frame ceilings shall be supported with Manufacturers supplied bar hangers and shall be installed according to the Manufacturer's instructions.
 - 3. Surface mounted luminaires solely supported by recessed boxes in a gypsum board ceiling shall have a 1-1/8" steel bar screwed or welded to the back of the box. This steel bar must be long enough to span two ceiling support channels and shall be attached to the channels by twisting wire around the bar and the support channel. For luminaires weighing over 50-pounds, provide studs in recessed box.
 - 4. Support surface mounted luminaires more than 18" wide at or near each corner or edge, in addition to support from outlet box.
 - 5. Support recessed downlights manufactured with built-in brackets by twisting wire around the bracket and two adjacent ceiling support channel runners on either side of the luminaire.
 - 6. Support outlet boxes as specified in Section 260533: Boxes. Provide all boxes with grounding pigtail.
 - 7. On concrete ceilings, use one of the following for supporting luminaires other than by outlet box:
 - a. Preset concrete inserts, provided inserts are completely covered by the luminaire after installation.
 - b. 1/4-20 threaded appropriate length wedge type anchor.
- B. Seismic supports:
 - 1. Recessed luminaires in suspended ceilings shall be supported by connecting two support wires to the luminaire at diagonal opposite corners for luminaires weighing 56 pounds or less. Connect four wires, one at each corner for luminaires weighing more than 56 pounds.
 - 2. Surface mounted luminaires on suspended ceilings shall be attached to the main ceiling runner with at least two positive clamping devices and shall have an additional support wire attached to each clamping device and to the structure above.

3. Recessed downlight luminaires in suspended ceilings shall be supported by connecting one support wire to the luminaire housing.
4. All suspended luminaires shall be able to swing 45-degrees from vertical in any direction without obstruction.
 - a. Furnish suspended rigid pendant luminaires with universal joint type hanger canopy and longitudinal sway adapter at each stem, to permit 45-degree swivel on 360-degree circle at canopy and 45-degree longitudinal movement at sway adapter.
 - b. Submit Drawings of hanger assembly for review prior to ordering.
 - c. If suspended luminaire is not free to swing 45-degrees in any direction, without obstructions, provide seismic restraint to prevent contact in conformance with California Uniform Building Code, Section 2330, Seismic Design.
5. All recessed modular luminaires shall be furnished with earthquake clips where installed in tee bar ceiling.

3.06 INSTALLATION OF POLES

- A. General: Store poles on decay-resistant treated skids at least 1-foot above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B. Metal poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.
- C. Wood poles: Do not drag treated poles along the ground. Do not handle poles with tongs, cant hooks and other pointed tools capable of producing indentation more than ¼-inch in depth. Do not apply tools to ground line section of poles.
- D. Pole installation: Use fabric web slings (not chain or cable) to raise and set poles.

3.07 CONCRETE FOUNDATIONS

- A. Construct concrete foundations conforming to Division 03, Section "Cast-In-Place Concrete."
- B. Utilize manufacturer's bolt templates to properly position anchor bolts.
- C. Provide leveling nut to anchor bolt prior to pole base. After pole leveling, pack non-shrink grout between pole base and concrete foundation.
- D. Comply with details and Manufacturer's recommendations for reinforcing, anchor bolts, nuts and washers.

3.08 ATTIC STOCK

- A. Spare Parts: Provide spare parts totaling 5 percent of the quantity specified, or two total, whichever is greater, of the following:
 1. Luminaires:
 2. Lenses:
 3. LED Drivers:
 4. LED Modules:

3.09 IDENTIFICATION SYSTEM

- A. All concealed junction box cover plates for the lighting branch circuit system shall be clearly marked with a permanent black ink felt pen identifying the branch circuit (both panel designation and circuit number) contained in the box.

3.10 FIELD QUALITY CONTROL

- A. Visual and mechanical inspection:
 - 1. Inspect for physical damage, defects, alignment and fit.
 - 2. Perform operational test of each luminaire after installed, circuited, and energized.
 - 3. Perform emergency operational test of all luminaires connected to emergency circuiting by simulating normal power source failure.
- B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.11 MOCK-UPS

- A. The purpose of the mock-up is to study the general appearance and performance of and to make comparisons between the various lighting systems. At that time, certain minimal test variations may be requested as to lamp location, lamp type, reflector shape, color, etc. Final modifications, if any, shall be considered a part of these Specifications and shall be accomplished with no additional cost to the Owner.
- B. Where noted in the Luminaire Schedule, the Contractor shall provide sample(s) for use in full-size field mockup of specific luminaires.
- C. The Contractor shall allow time in the bid and be responsible for procuring and installing a sample luminaire on the Project for review, prior to acceptance and final installation.
- D. This mock-up will be required to be coordinated and reviewed with the Owner's Representative and the Architect or Engineer.
- E. The Contractor shall be responsible for providing the labor and materials for the field mock-up including, but not limited to, special rigging or scaffolding and adjustments in the field, as directed by the Architect or Engineer.
- F. The mock-up installation shall closely conform to the conditions of the actual final installation as to height, distance from adjacent surfaces, number and type of lamps, material, color, etc.
- G. The Contractor shall submit a written description of each proposed mock-up with Drawings in order to obtain Architect's approval prior to commencement of each mock-up.
- H. Exterior mockups will occur at night, starting 2-hours after local sunset. Dates to be coordinated with design team to suit schedules. Contractor to propose multiple dates at least 4 weeks in advance.
- I. Allow two, 6-hour mockup sessions per luminaire. The second mockup, if required, will occur after additional or alternate equipment is available.
- J. Contractor to provide all required security, sidewalk closures, lifts, walkie-talkies (4 minimum) and manpower to make changes to color and intensity of the temporary luminaires.
- K. Mockup luminaire shall not be used for final permanent installation unless approved by the design team.

3.12 ADJUSTING AND AIMING

- A. Aiming will occur at night under the direction of the Owner's Representative and the Architect or Engineer. The Contractor shall be responsible for providing the labor and materials for field aiming. This shall include, but not limited to, special rigging or scaffolding, adjusting luminaires in field, testing of various lenses or louvers, as directed by the Architect or Engineer.
- B. Aim all directional luminaires, including but not limited to luminaires described in the Contract Documents or by the luminaire manufacturer as "aimable," "adjustable," or "asymmetric" as follows:
 - 1. To provide the lighting pattern for which the luminaire is designed.
 - 2. To provide the lighting pattern as shown on the drawings.
 - 3. To predetermined aiming points as shown on the drawings.
 - 4. Where aiming cannot be determined, request, in writing, clarification from the Specifier, indicating luminaires needing clarification.
- C. Re-aim luminaires as determined by Architect during final project walkthrough.

3.13 CLEANING

- A. Clean luminaires prior to Project closeout in accordance with Manufacturer's recommended materials and methods.
- B. Remove all debris, fingerprints, and packaging remnants.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies the common administration basic requirements and common methods for all low voltage systems installation work included under Division 27 and 28 and where those requirements differ from the requirements of this section, the more stringent shall govern.

1.02 STANDARDS, REGULATIONS, AND CODES REFERENCES

- A. The following Standards, Regulations and Codes apply to work specified in the Contract Documents.
1. Applicable State and Local Codes.
 2. California Building Code and California Electrical Code, Current Editions.
 3. BICSI TDMM (Telecommunications Distribution Methods Manual), 11th Edition 2006.
 4. ANSI/TIA/EIA-568-B.1. Commercial Building Telecommunications Cabling Standard,
 5. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 2, Grounding and Bonding Specifications for Screened Balanced Twisted-Pair Horizontal Cabling.
 6. ANSI/TIA/EIA-568-B.1-3. Commercial Building Telecommunications Cabling Standard.
 7. ANSI/TIA/EIA-568-B.1-4. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 4, Recognition of Category 6 and Category Cat 6A and 50 nm Laser-Optimized 50/125 um Multimode Optical Fiber Cabling.
 8. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 9. ANSI/TIA/EIA-568-B.2-1. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 1, Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.
 10. ANSI/TIA/EIA-568-B.2-10 (draft 2.0). Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 10, Transmission Performance Specifications for 4-Pair 100 Ohm Augmented Category 6 Cabling.
 11. ANSI/TIA/EIA-568-B3.3 Optical Fiber Cabling Components Standard.
 12. TIA-569-B. Commercial Building Standard for Telecommunications Pathways and Spaces.
 13. ANSI/TIA/EIA-606-A. Administration Standard for Commercial Telecommunications Infrastructure.
 14. ANSI/TIA/EIA-607-A. Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

15. TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
16. TIA/EIA TSB-72 Centralized Optical Fiber Cabling Guidelines.

1.03 DEFINITIONS

- A. The following is a list of abbreviations generally used in Divisions 27 & 28:
1. ADA - Americans with Disabilities Act
 2. AHJ - Authority Having Jurisdiction
 3. ANSI - American National Standards Institute
 4. APWA - American Public Works Association
 5. ASTM - American Society for Testing and Materials
 6. CBC - California Building Code
 7. CEC - California Electrical Code
 8. CFC - California Fire Code
 9. FCC - Federal Communications Commission
 10. HVAC - Heating, Ventilating and Air Conditioning
 11. IEC - International Electro-technical Commission
 12. IEEE - Institute of Electrical and Electronics Engineers.
 13. IETA - International Electrical Testing Association
 14. FM - FM Global
 15. NEMA - National Electrical Manufacturers Association
 16. NFPA - National Fire Protection Association
 17. OSHA - Occupational Safety and Health Administration
 18. UL - Underwriters Laboratories Inc.
- 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, installing, applying, finishing, protecting, cleaning and similar operations at the project site to complete items of work furnished by others.
- E. Following is a list of commonly used terms in Division 27:
1. Active Equipment: Electronic equipment used to develop various WAN and LAN services.
 2. Backbone: Collective term sometimes used to describe the campus and vertical distribution subsystem facilities and media interconnecting service entrances, communications rooms, and communications cabinets.
 3. Bonding: Permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to safely conduct currents likely to be imposed on it.
 4. Cabinet: Wall-mounted modular enclosure designed to house and protect electronic equipment.

5. Cable Tray: Vertical or horizontal open supports, usually made of aluminum or steel, that are fastened to a building ceiling or wall. Cables are laid in and fastened to the trays. A cable tray is not a raceway.
6. Campus: Grounds and buildings of a multi-building premises environment.
7. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; may include one or more links, cross-connect jumper and/or patch cords, and work area station cords. Does not include connection to active equipment.
8. Cross-Connect: Equipment used to terminate and tie together communications circuits.
9. Cross-Connect Jumper: A cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
10. Fiber Optic Distribution Unit (FDU): Cabinet with terminating equipment used to develop fiber optic cross-connect facilities. Also known as LIU.
11. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
12. Hinged Cover Enclosure: Wall-mounted box with a hinged cover that is used to house and protect electrical devices.
13. Horizontal: Pathway facilities and media connecting the MDF or IDF to Telecommunications Outlets.
14. Intermediate Distribution Frame (IDF): Data networking equipment rack and/or location that serves an individual area, floor or building. Downstream from the MDF.
15. Jack: Receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
16. Link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables; one continuous section of conductors or fiber, including the connecting hardware at each end.
17. Local Area Network (LAN): Data transmission facility connecting several communicating devices, typically Ethernet and the network is limited to a single campus.
18. Main Distribution Frame (MDF): Initial (main) data network equipment rack and/or location. Only one MDF occurs per site and may serve many downstream IDFs.
19. Media: The type of cable (e.g., twisted-pair, coaxial, or fiber optic) used to provide signal transmission paths.
20. Minimum Point of Entry (MPOE): The location where the service provider hands off connection and responsibility for service to on premise customer owned equipment.
21. Modular plug: An eight-position, eight-conductor end-of-wire electrical connector used with Category rated cable.
22. Passive Equipment: Non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, wiring blocks, FDUs, etc.
23. Patch Cord: A length of copper or fiber cable with connectors on both ends used to join communications circuits at MDF/IDF and end stations.
24. Patch Panel: System of terminal blocks or connectors used with patch cords that facilitate the administration of cross-connect fields.

25. Pathway: Facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, underfloor systems, raised floor, ceiling support wires, etc.
26. Protectors: Electrical protection devices used to limit foreign voltages on metallic communications circuits.
27. Raceway: An enclosed channel designed expressly for holding wires or cables; may either be conductive metal or insulating plastic. The term includes conduit, tubing, wireway, underfloor raceway, and surface raceway; does not include cable tray.
28. Rack: An open or enclosed structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack. May be freestanding and floor mounted or a wall mounted cabinet. Industry standard 19" width spacing.
29. Wiring Block: Punch down terminating equipment used to develop twisted pair cross-connect facilities.

1.04 PRODUCT AVAILABILITY

- A. Products with long lead times are to be brought to the attention of the project manager.

1.05 PRODUCT SUBMITTALS

- A. See Division 01 Submittals for more requirements

1.06 SUBSTITUTION LIMITATIONS

- A. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) must be approved, and show demonstrated and documented equivalence to the product(s) specified. Documentation includes but is not limited to product samples, data sheets, and actual test data. The request for product substitution, and supporting documentation, must be submitted, in writing to the Project Manager/Designer.
- B. See Division 01 Substitutions for more requirements

1.07 QUALITY ASSURANCE

- A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
- B. Conform to the latest adopted version of the CBC with amendments by local AHJs.
- C. Obtain and pay for electrical permits, plan review, and inspections from local AHJs.
- D. Furnish products listed by UL or other testing firm acceptable to AHJ.

- E. Conform to requirements of the serving electric, telephone, broadband and cable television utilities.
- F. Contractor Qualifications:
 - 1. Minimum of five years' experience in the design, installation, testing, and maintenance of low-voltage systems.
 - 2. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
 - 3. Have performed successful installation and maintenance of at least three projects similar in scope and size. Be able to provide project references for these three projects, including scope of Work, project type, owner/user contact name and telephone number.
 - 4. The contractor selected for this project must be certified by the manufacturer of the products and utilize these components for completion of work.
 - 5. Holds and maintains a valid California C-7 or C-10 State Contractors License and can exhibit validity upon request.
 - 6. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic cable systems used.
 - 7. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who will be assigned to this project.
 - 8. A list of technical product training attended by the contractor's personnel that will install the specified manufacturer system.
 - 9. List of Sub-Contractor(s) who will assist the contractor in the performance of this work.

1.08 SEQUENCING AND SCHEDULING

- A. For the proper execution of the work, cooperate with other tradecrafts and contracts as needed.
- B. To avoid installation conflicts, thoroughly examine the complete set of Contract Documents. Resolve conflicts with Project Manager/Designer prior to installation.
- C. Prior to installation of communications cable to equipment requiring connections, examine the manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that the electrical characteristics detailed in the Contract Documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Project Manager/Designer.

1.09 SHOP DRAWINGS

- A. Shop Drawings: When required by individual Specification Sections, provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, point-

to-point wiring diagrams for all connections, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.

1.10 WARRANTY

- A. Provide an extended manufacturer's warranty on the Backbone and Horizontal Communications systems as specified in other sections of Division 27.

1.11 CLOSE OUT DOCUMENTS

- A. Final coordination drawings, with as-built information added, are to be submitted as record drawings at completion of project.
- B. Record Drawings:
 - 1. Show changes and deviations from the Construction Drawings. Include written Addendum and change order items.
 - 2. Show exact routes of pathway facilities and service entrance conduits.
 - 3. Show the exact location of racks, cabinets, mounting frames and the like.
- C. Operation and Maintenance Documentation: Provide copies of certificates of code authority acceptance, product data, guarantees, warranties, installation guides, maintenance guides and the like.
- D. Inspection and/or testing: Submit testing reports for testing that was performed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide like items from one manufacturer, such as wire/cable, jacks, modular plugs, patch panels, equipment connection cords, wall plates, and the like. See individual sections for detailed information.

2.02 MATERIALS

- A. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand names and catalog numbers are used to establish standards of performance and quality.
- B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide plenum rated cable in ceilings that are utilized as air return plenums.
- C. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.
- D. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system, in a safe and satisfactory working condition.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Construction Documents:

1. Drawings are diagrammatic with symbols representing communications equipment, outlets, and wiring.
2. Electrical symbols indicating wiring and equipment shown in the Contract Documents are included in the Contract unless specifically noted otherwise.
3. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of communications wiring and equipment with conditions of construction.

3.02 INSTALLATION

- A. Install communications equipment completely as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of the communications equipment, examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from Project Manager/Designer prior to proceeding with the installation.
- B. Do not install communications equipment in obvious passages, doorways, scuttles, or crawl spaces which would impede or block the passage's intended usage.
- C. Do not install communications equipment in locations where it would obviously be subject to damage during normal usage.

3.03 FIELD QUALITY CONTROL

- A. Tests: Conduct tests of equipment and systems to demonstrate compliance with requirements specified in Division 27 & 28. Refer to individual Specification Sections for required tests. Document tests and include in Closeout Documents.

3.04 CLEANING

- A. Remove dirt and debris caused by the execution of the communications work.
- B. Leave the entire communications system installed under this Contract in a clean, dust-free, and proper working order.

- C. Vacuum clean interiors of new and modified electrical signal and communication equipment enclosures.

END OF SECTION

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section specifies the basic materials and methods for all low voltage pathways installation work included under Division 27 and 28 and where those requirements differ from the requirements of this section, the more stringent shall govern.
- B. This section adds refinements to Division 26 that apply to Communications and extra-low-voltage systems.

1.02 SCOPE

- A. Materials and/or methods for the following.
 - 1. Communication services
 - 2. Grounding
 - 3. Fasteners
 - 4. Hangers and supports
 - 5. Conduits/Backboxes/Raceways
 - 6. Underground
 - 7. Sleeves and penetrations

1.03 SUBMITTALS

- A. Submittals shall be done in accordance with District submittal procedures, see Division 01 Submittals for requirements.

1.04 RELATED REQUIREMENTS

- A. Division 07 – Thermal and Moisture Protection
- B. Division 26 – Electrical
- C. 27 00 00 – Communications Basic Requirements

1.05 REFERENCES

- A. ANSI American Nation Standards Institute

- B. NFPA 70 – National Electrical Code
- C. UL Underwriters Laboratory
- D. California Building Code (CBC)
- E. California Electrical Code (CEC)

1.06 WARRANTY

- A. Refer to Division 01 -- Warranties

PART 2 – PRODUCTS

2.01 All products used on this project shall bear the label and be approved by Underwriters Laboratories unless otherwise approved in writing by District.

2.02 FASTENERS

A. Mounting hardware and anchors recommended by the manufacturer of any material that shall be mounted to the building or structure.

1. Sheet rock / drywall / wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
2. Concrete / cinder block / solid masonry: Expanding compression type lag, expanding compression type bolt, expanding compression type, all-thread with nuts, or approved equal.
3. Tile / Stucco / hollow masonry: Toggle bolts or approved equal.
4. Wood: Lag screws, wood screws, or approved equal.
5. Metal: Beam clamps, sheet metal screws, self-drilling screws or approved equal.

2.03 HANGERS AND SUPPORT

A. D-RINGS

1. Commercial grade

B. J-HOOKS

1. Commercial grade

2.04 SURFACE RACEWAY

A. The District has standardized on Wiremold 800, 2300, 5400 and 5500 series for non-metallic surface raceway.

2.05 CONDUITS AND ACCESSORIES

A. CONDUITS

1. See Division 26 for requirements.
2. Conduit for Fire Alarm applications shall be red in color (non-accessible areas are excluded).

3. All new conduits shall be sized accordingly to achieve a 40% maximum fill ratio with initial cables installed.
4. Underground conduits shall be Schedule 40 PVC.

B. INNERDUCT

1. Orange corrugated HDPE (High Density Polyethylene) Innerduct shall be used for fiber optic cable protection in interior locations.
2. Fabric multi-cell innerduct is approved for underground conduits 2" and larger.

C. FITTINGS:

1. See Division 26 for requirements.
2. Conduit bodies and any sharp bend fittings are strictly prohibited for communication Cat6A and fiber optic cables. Appropriate conduit sweeps are required.

D. PULL LINE

1. Minimum 1/8" diameter, or larger braided line of polypropylene or continuous fiber polyolefin. The minimum breaking strength of 1/8 in. line is 200 lbs.

2.06 BACKBOXES, JUNCTION BOXES AND FLOOR BOXES

- A. Galvanized one-piece or welded pressed steel type. Boxes for fixtures shall not be less than 4" square and shall be equipped with fixture stud. Boxes shall be at least 2-1/8" deep, 4" square for 1 or 2 gang devices, with device rings. Boxes mounted in wall or ceiling finished with 5/8" gypsum board shall be furnished with 5/8" deep device rings. Provide blank cover for all boxes without fixture or device.
- B. Junction boxes, larger than 8", located indoors shall be hinged, NEMA-1 rated.
- C. Junction boxes, larger than 8", located outdoors, or in wet or damp locations shall be hinged, NEMA-3R.
- D. Provide and install tamper-proof screws for all exterior boxes.
- E. Junction boxes used for Fire Alarm systems are to be red in color with red colored cover plates.

2.07 GROUND BOXES

- A. See Division 26 and below for requirements.
- B. Approved manufactures are Jensen, Christy or approved equal.
- C. All ground boxes shall have metal traffic-rated lids with permanent factory markings of COMM or COMMUNICATIONS.
- D. Minimum size is 17" x 30"
- E. For AT&T service feeds the requirement is for 30"x48" Intercept Pullboxes. Jensen SKU 100020251/Mod # K304836AT was referenced by AT&T.
- F. For Comcast - Christy B2436 at service tie in and B1730 as an inline pullboxes are acceptable.

2.08 PENETRATION SEALING

- A. Firestopping: Provide UL Listed Firestopping materials for all penetrations through rated assemblies (walls / floors). See Division 07 for more information.
- B. Draft stopping: Foam sealant for use around conduit penetrations (in non-rated assemblies) to prevent passage of air, smoke, and/or toxic gas. See Division 07 for more information.
- C. Weatherproofing: Weatherproof sealant for use around conduit penetrations in exterior walls to prevent the intrusion of water. See Division 07 for more information.

2.09 GROUNDING BUS BAR

- A. Copper bus bar 2"x10"x1/4" minimum size with stand-off brackets and insulators, pre-drilled and threaded mounting holes (hole qty. 12 or greater) for equipment grounding lug attachment.

PART 3 - EXECUTION

3.01 COMMUNICATION SERVICES

- A. Install inground boxes, conduits, and terminal cabinets per service provider requirements.

3.02 GROUNDING

- A. Ground fittings shall be UL approved for each application and installed and/or connected to system in accordance with current CEC Code requirements.
- B. See Division 26 for additional requirements.
- C. Install grounding bus bar per manufacturer's instructions and to be in each MDF and IDF.

3.03 HANGERS AND SUPPORTS

- A. Install hangers and supports per manufacturer's written instructions.
- B. Hanger spacing shall be 48" or less and within 12" of sleeves and/or junction/back boxes.

3.04 LOW VOLTAGE PATHWAY/RACEWAYS

- A. EMT conduit may be used at following locations (see Division 26 for exact requirements):
 - 1. In dry locations in furred spaces.
 - 2. In partitions other than concrete or solid masonry.
 - 3. In protected exterior locations not exposed to direct weather.
- B. Rigid steel conduit and fittings shall be used for vertical risers and on top of all roofs, overhangs, walkways, canopies, or any other location exposed to direct weather. See Division 26 for exact requirements.
- C. Furnish and install pull lines in all unused (empty) conduits or raceways. All pull lines shall be permanently tagged with identification at both ends.
- D. Install exposed conduit neatly, parallel to or at right angles to structural members. Maintain a minimum of 12 inches of clearance from steam or hot water pipes. All installed strut channel supports should allow for future conduit attachments. The width of strut channel to match the width of the closest attached junction box. See design document details for attachment requirements.
- E. Supports: Support conduit with two-hole straps or strut channel where shown in design documents and/or specified. Coordinate supports with architectural details. Secure to wood

- structure by means of bolts or lag screws, to metal by means of shallow self-tapping screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry or stucco by means of toggle bolts.
- F. Spacing for all EMT and rigid steel conduit supports shall be as follows unless otherwise specified in design documents details:
1. Surface conduit spacing and supports and unless otherwise specified or shown on drawing details:
 - a. EMT – Size 3/4" to 2" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
 - b. Rigid steel – Size 3/4" to 2" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
- G. If conduit is designated for low voltage use, no more than a total of 360 degrees of conduit bend radius will be allowed between pull boxes.
- H. All junction boxes shall be connected to conduits using appropriate connecting hardware (i.e. box connectors).
- I. Clean, prep and paint with white primer all exposed conduit, junction boxes, channel strut, fittings, and accessories.
- J. Before pulling any conductors into an underground PVC conduit (new or existing), the conduit shall be first be proofed by pulling through a mandrel of a diameter ¼ in. smaller than the conduit inside dia., followed by a swab of the same diameter as the conduit inside diameter.
- K. Non-metallic raceway to be installed with mechanical fasteners only, do not remove adhesive tape backing.
- L. Capping
1. Cap conduits during construction with manufactured seals. Swab out conduits before installing wires.
 2. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of debris, attach pull string to cap.

M. Underground Conduit

1. Service provider conduits shall be:
 - a. AT&T - 1-4" (fiber only) or 2-4" (fiber and copper)
 - b. Comcast - 1-2"
2. #10 tracer wire or tracer tape is required for all underground Division 27 PVC conduits.

3.05 J-BOXES

- A. Screws shall be used to attach boxes, and must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers.
 1. Boxes shall be attached to metal studs with metal box hangers.
 2. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.
- B. Locate outlets at the following heights unless otherwise noted on Drawings, Specifications, current CBC or as required to meet ADA handicap requirements.
 1. Data Outlets: Same height as electrical outlets
 2. Telephone Wall Outlets: Above counter/backsplash height or at electrical switch height.
- C. Boxes shall be placed within 18" of electrical outlets.
- D. For sound control, separate outlets on opposite sides of walls 16" minimum. Where outlets are less than 16" or in sound rated walls, seal airtight with fire rated sheet putty pads. Fill gap between junction box and wall with acoustical sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated putty.
- E. Installation of conduit and outlet boxes in fire-resistive walls, floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 713.

3.06 GROUND BOXES

- A. To be installed per Division 26 requirements.
- B. Provisions to be made for supporting cables from the box sides (i.e., j-hooks, d-rings)

- C. Install a 30" x 48" for service provider AT&T at service tie-in location and/or a 24" x 36" for service provider Comcast at service tie-in location. If less than 360-degrees of bends and less than 200 feet it is acceptable to stub in to the MPOE directly. If greater for 360-degree for bends or 200 feet for length then additional in-line ground boxes are required (30" x 48" for AT&T, 17" x 30" for Comcast). See section Part 2 – Products for more information.

3.07 SLEEVES AND CONDUIT PENETRATIONS

- A. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceways mounted to the same wall as the penetration provide a threaded conduit and secured in place with locking rings on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed to comply with this requirement.
- B. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceways not mounted to the same wall as the penetration, provide EMT conduit and secured in place with strut channel. Box connectors shall always be used to connect EMT to junction boxes and raceways.

C. FIRE STOPPING

- 1. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with current CBC and current CEC. See Division 07 for more information.

D. DRAFT STOPPING

- 1. All non-fire rated walls must be draft stopped and sealed. Submit method to be used for approval by inspector and/or project manager. Mineral wool is one product that may be used. See Division 07 for more information.

E. WEATHER SEALING

- 1. All exterior penetrations shall be sealed watertight. The contractor shall use silicon rubber caulk or other approved methods and materials. Submit method and material with inspector and/or project manager. See Division 07 for more information.

3.08 CLEANING

- A. Clean all work prior to concealing, painting, and acceptance. Performed in stages if directed.

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- 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 equipment and enclosures.

3.09 FINAL DOCUMENT SUBMITTALS

- A. See 27 00 00 for more information.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable Structured Cabling communications system. The system shall provide highly reliable and high-performance data communication from main distribution frame (MDF) through each intermediate distribution frame (IDF) to end points requiring fiber optics and/or copper cabling and associated equipment.
- B. This section condenses sections 27 11 00 – Communications Equipment Room Fittings, 27 13 00 – Communications Backbone Cabling, 27 15 00 – Communications Horizontal Cabling and 27 16 00 – Communications Connecting Cords into one comprehensive section.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
 - 1. Contractor shall furnish and install all required components and accessories as outlined in the design documents for a complete and operable turn-key system.
 - 2. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the standards and requirements prior to beginning work
 - 3. The Contractor shall furnish and install all required fire-treated $\frac{3}{4}$ " (three quarter inch) plywood for the MDF and all IDF locations.
 - 4. The Contractor shall furnish and install a ground bus bar at the MDF and IDF rooms.
 - 5. The Contractor shall furnish and install all required racks and cabinets.
 - 6. The Contractor shall furnish, install, and configure uninterruptable power supply(ies) (UPS) for the MDF and/or IDF racks.
 - 7. The Contractor shall furnish and install all newly required conduit/raceway.
 - 8. The Contractor shall furnish and install all wire/cable (copper/fiber optic) as required.
 - 9. The Contractor shall terminate all strands of fiber at each fiber enclosure.
 - 10. The Contractor shall furnish and install termination all end-point equipment (patch panels, jacks, wallplates, enclosures, etc.).
 - 11. The Contractor shall furnish and install all patch cords (copper/fiber).
 - 12. The Contractor shall test and certify installed cable plant.

1.03 RELATED REQUIREMENTS

- A. Section 01 – General Requirements
- B. Section 27 00 00 – Communications
- C. Section 27 05 00 – Common Work Results for Communication Systems.

1.04 INDUSTRY GUIDELINES AND STANDARDS

- A. California Electrical Code (CEC) – Current adopted version
- B. California Building Code (CBC) – Current adopted version.
- C. ANSI/TIA-568.0-D – Generic Communications Cabling for Customer Premises.
- D. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.
- E. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- F. ANSI/TIA 568.3-D – Optical Fiber Cabling Components Standard
- G. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.
- J. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.
- K. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.

1.05 QUALIFICATIONS

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall have 5 years' documented experience.

1.06 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

1.07 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See section 27 00 00 for requirements.

1.08 SUBMITTALS

A. See section 27 00 00 for requirements.

1.09 WARRANTY

A. Refer to Division 01 Warranty section.

B. See section 27 00 00 for additional requirements.

C. 15-year manufacturer's warranty/certification required for all copper and fiber cable plant installations.

1.10 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Contractor shall confirm all equipment part numbers with the Project Manager or District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.
- E. Install mounting hardware and anchors as recommended by the Manufacturer of the equipment that requires mounting to the building or structure and adhere to all code requirements. See section 27 05 00 for requirements.
- F. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2.02 MANUFACTURERS AND PRODUCTS

- A. See Appendix A at the end of this document for pre-approved materials.
- B. Substitutions require proof of equivalence and approval by District and/or its representative.

2.03 COPPER/FIBER OPTIC CABLES AND COMPONENTS

- A. All copper cables and components shall be Cat6A rated.
 - 1. Cable to be reduced diameter. White jacket for default cable, Blue jacket for CCTV and Access Control only.
 - 2. Jacks to be keystone style.
- B. Patch cords system/color:
 - 1. Data = Blue color
 - 2. AP = Green color
 - 3. CCTV = Blue color

4. Clock/Intercom = Yellow color
 5. Access Control = Black color
- C. Data jacks system/color:
1. Data/default = White color
 2. AP = Green color
 3. CCTV = Blue color
 4. Clock/Intercom = Yellow color
 5. Access Control = Black color
- D. All fiber optic cables and components shall be single single-mode OS2 rated.
- E. Fiber optic cable terminations shall be LC-Duplex style.

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The components making up the structure cabling system shall only be installed by Contractors who are qualified to install, service and maintain the system.
- B. Cable terminations (copper or fiber) shall be installed by manufacturer certified technicians.
- C. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to job bidding. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for accurate bidding and performance of the Work.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall verify the availability of power where required.

3.04 SHOP DRAWINGS

- A. The Contractor shall create "Shop Drawings" per section 27 00 00 for this section.
- B. Submit drawings for review and approval by the Project Manager and/or Designer.

3.05 INSTALLATION

A. ENTRANCE FACILITIES

- 1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.
- 2. Install underground or aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

B. UNDERGROUND ENTRANCE PATHWAY

1. Install underground entrance pathway complying with Division 26.

C. EQUIPMENT RACKS, CABINETS, ENCLOSURES AND ACCESSORIES

1. Backboards:
 - a. Shall be installed behind the rack or cabinet if the cabinet is not able to be directly attached to two vertical wall studs.
 - b. Backboards shall be made of fire retardant or treated materials, squarely cut, and with sanded edges
 - c. Backboards shall be a minimum $\frac{3}{4}$ " thick and large enough to secure it to two vertical wall studs.
 - d. The "FIRE RATED" stamp shall be visible.
 - e. Backboards shall be fastened with $\frac{1}{4}$ " lag bolt and washer, non-recessed, with maximum spacing of 18" into 2 vertical studs. 1-1/2" embedment.
2. All data & voice communications racks and cabinets shall be anchored in accordance with manufacturer's specifications, project specifications and/or drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.).
3. Securely mount equipment cabinet and racks to the building structure. A proper quantity of support fasteners shall be utilized. Typically lag bolts for wood installations, wedge anchors for concrete flooring. Submit data sheets for mounting fasteners for approval before installation. Mount equipment per DSA approved drawings/details.
4. Equipment cabinet mounted on or against walls will have 3-foot clearance in front of deepest component and accessible to rear for service.
5. MDF and all IDF's shall have at least one dedicated 120VAC 20-amp quad-receptacle each.
6. Patch Panels: Mount patch panels into the cabinet/rack. Match manufacturer of existing install or if new construction, see Appendix A.
7. Cable Management: Secure the cable bundle(s) to the rack strain relief and cable management behind the patch panels and cross connect block panels. Install horizontal cable management panels and brackets for routing and management of patch cables. Maintain TIA/EIA and BICSI standards on bundling, supporting and bend radius.
8. Surge Protected Outlet Strips: Required in MDF rack. Mount surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.

9. Furnish and install UPS in bottom of MDF/IDF rack.

D. MDF/IDF GROUNDING

1. Refer to Section 27 05 00 Grounding for more requirements.
2. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 6 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
3. Bond metallic equipment (including ladder rack) to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.06 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District' Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.

3.07 WIRE/CABLE (COPPER/FIBER OPTIC)

- A. Design, layout, size, and plan new cable runs as required.
- B. All wire and cable passing through metalwork shall be sleeved by an approved grommet or bushing.
- C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- D. Neatly dress and tie (Velcro) all cabling.
- E. UTP cabling shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the MDF, IDF and termination locations.

- F. Fiber optic cable shall be installed from the MDF to each IDF.
- G. Orange corrugated HDPE (High Density Polyethylene) Innerduct shall be used for fiber optic cable protection in all interior locations.
- H. Spicing of fiber optic cable shall be done with fusion splices.
- I. When required copper feeders (minimum 4-pair) are to be installed from the MDF to each IDF
- J. Maintain proper bend radius for all cable installations.
- K. Do not exceed cable manufacturer's instructions for installation pull load. Any cable damaged by excessive pull force shall be replaced by the installing contractor.
- L. Modular plug terminated link (MPTL) style wiring is acceptable for CCTV with modified single connector permanent link testing.

3.08 LABELING

- A. MDF/IDF - Identification number in large font on front of cabinet.
- B. MDF, Fiber Optic LIU Ports – IDF number and room number
- C. MDF/IDF, Copper Patch Panel – Panels labeled P1, P2, P3, etc., ports labeled with room number.
- D. LAN Outlet – IDF number, patch panel number, patch panel port number.
- E. Cables to be labeled both ends with unique identifiers and from/to location identifiers. For Copper Cat cable IDF number, patch panel number, patch panel port number.
- F. T-bar ceilings shall have device labels attached next to the device for ceiling mounted equipment and at the tile for above ceiling equipment with device type and device ID points/IP address.

3.09 CONDUIT AND RACEWAY INSTALLATION

- A. See Division 26 and section 27 05 00 for requirements.
- B. Conduit bodies and any other sharp bend fittings are strictly prohibited for communications cabling (copper/fiber).

- C. Install proper radius conduit sweeps where required.

3.10 FIELD QUALITY CONTROL AND TESTING

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify the District when ready to perform a re-inspection of the installation.
- F. Provide 15-year manufacturer's warranty/certification documentation for all copper and fiber cable plant installations.

3.11 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Rack Cabinet 7'	DAMAC	CS84EDB1BSS3
Wall Mount Cabinet 24"	DAMAC	WSR24ABP1VVV-3GP
Wall Mount Cabinet 48"	DAMAC	WSR48ABP1VVV-3GP
20 AMP Power Strip	DAMAC	P0828GM201
19" Rack Mount Ground Bar	DAMAC	ARGB019
Concrete Floor Rack Kit	DAMAC	ARRFCK-58
Fan Kit Enclosure	DAMAC	ATFK2
Grounding Strap Kit	DAMAC	PLA12GK
12" Ladder Rack 10'	DAMAC	PLR1210-3
Ladder Rack Wall Angle Support 12"	DAMAC	PLBA12-3
Ladder Rack Junction Plate	DAMAC	PLB12RS-3
Ladder Rack Protective End Caps	DAMAC	PLAEC
19" Horizontal Cable Manager	DAMAC	F533-1901
Patch Panel 24-port 1-RU (Black)	Ortronics	OR-SPKSU24
Patch Panel 48-port 2-RU (Black)	Ortronics	OR-SPKSU48
Faceplate, 2-port (White)	Ortronics	KSFP2-88
Faceplate, 4-port (White)	Ortronics	KSFP4-88
Surface Mount, 2-port (White)	Ortronics	KSSMB2
Cat6A Data Jacks (White)	Ortronics	KT2J6A-88
Cat6A Data Jacks (Green)	Ortronics	KT2J6A-45
Cat6A Data Jacks (Blue)	Ortronics	KT2J6A-36
Cat6A Data Jacks (Yellow)	Ortronics	KT2J6A-44
Cat6A Data Jacks (Black)	Ortronics	KT2J6A-00
Cat6A Data Cable, Reduced Diameter, Riser (White = default)	Berk-Tek	11143100
Cat6A Data Cable, Reduced Diameter, Plenum (White = default)	Berk-Tek	11141651
Cat6A Data Cable, Reduced Diameter, Riser (Blue = CCTV/Access Control)	Berk-Tek	11142398
Cat6A Data Cable, Reduced Diameter, Plenum (Blue = CCTV/Access Control)	Berk-Tek	11141650
Cat6A Data Cable, Reduced Diameter, Indoor/Outdoor (Black)	Berk-Tek	
Cat6A Patch Cord (Blue)	Quiktron	576-A10-0xx (xx = length)
Cat6A Patch Cord (Green)	Quiktron	576-A20-0xx (xx = length)
Cat6A Patch Cord (Yellow)	Quiktron	576-A115-0xx (xx = length)
Cat6A Patch Cord (Black)	Quiktron	576-A135-0xx (xx = length)
Cat6 Patch Cord Slim 1' (Blue)	C2G	01072

STRUCTURED CABLING**27 10 00 - 12**

Cat6 Patch Cord Slim 1' (Green)	C2G	01160
Cat6 Patch Cord Slim 1' (Yellow)	C2G	01070
Cat6 Patch Cord Slim 1' (Black)	C2G	01098
Fiber Optic LIU 1-RU	Ortronics, Infinium	INFC01U-M4-E
Fiber Optic LIU 2-RU	Ortronics, Infinium	INFC02U-M4-E
Fiber Optic Adapter	Ortronics, Infinium	HDFP-LCD12AC
Fiber Optic LC Field Term Connector	Ortronics	205KAN9GASM
Fiber Optic Fanout Kit	Ortronics	61500858
Fiber Optic Cable Single-Mode OS2, Indoor/Outdoor	Superior Essex	W4012J101
Fiber Optic Cable Single-Mode OS2, Indoor/Outdoor	Berk-Tek	PDP012AB0707-I/O-C4(YEL)

END OF SECTION

SECTION 27 41 00
AUDIO-VISUAL SYSTEMS

PART I - GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable audio-visual system. This system shall provide multi-media presentation capabilities for education and instructional purposes.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
 - 1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of turn-key audio-visual systems to the District.
 - 2. The Contractor shall be responsible for all programming, commissioning, and activation of the Audio-Visual System.
 - 3. The contractor will coordinate with the District in writing for any needed information (i.e. IP addresses, etc.) At least 2 weeks prior to date the information is needed.
- B. The District has standardized on 86" interactive flat panel display for standard classroom teaching A-V. The interactive display shall be integrated with the Assistive Listening System, see Section 27 51 26 for requirements.
- C. The multi-purpose room shall be equipped with an integrated audio-visual system consisting of a video projector, rear-projection screen, video switcher, audio DSP, speakers, and related components, as indicated on the project documents. The audio-visual system shall be integrated with the Assistive Listening System, see Section 27 51 26 for requirements.
- D. Not used.
- E. The Contractor is responsible for user/operator training (typically 1-2 hours).
- F. The Contractor shall complete all required project closeout documentation in a timely fashion.

1.03 RELATED REQUIREMENTS

- A. Division 01 – General Requirements
- B. Section 27 00 00 - Communications
- C. Section 27 05 00 – Common Work Results for Communication Systems.
- D. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

- A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

- A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

- A. Not used.

1.07 SUBMITTALS

- A. See section 27 00 00 for requirements.
- B. Submittals shall include all Extron touch-screen interface programming including each menu, submenu, and popup for review and approval by the District.
- C. Post construction submittals
 1. Provide as-built documentation in accordance with Section 3.
 2. Submit owner’s manual binders of all equipment documentation.
 3. Provide a laminated simple operational sheet for end-users of system.
 4. Provide backup copies of all A/V system programming files, including “uncompiled” copies of all Extron programming and backups of the Audio DSP programming.

1.08 CONTRACTOR “SHOP DRAWINGS” DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.
- B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

- A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- B. Five (5) years' experience installing Assistive Listening/AV equipment systems.
- C. The contractor shall possess a California a C7 or C10 license.
- D. The Contractor or Subcontractor shall be AV equipment manufacturer authorized to provide and install equipment with 5 years documented experience.

1.10 CERTIFICATIONS

- A. Installers shall be manufacturer certified.

1.11 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.
- F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The approved manufacturers for the project are:
 - 1. A-V Control unit and related accessories: Extron
 - 2. Interactive flat panel display: Newline
 - 3. See Appendix A for additional pre-approved equipment/materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.
- D. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
 - 3. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.
- E. HDBaseT cable shall be manufacturer-specified shielded twisted pair specialty cable including manufacturer-specified terminations. For example, Extron systems shall utilize Extron-branded DTP cable and terminations.

2.02 EQUIPMENT

- A. See Appendix A at the end of this document for pre-approved materials.
- B. Substitutions require proof of equivalence and prior approval by District and/or its representative before ordering.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The equipment shall only be installed by Contractors who are qualified and certified by the manufacturer to install and maintain the system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing educational A-V equipment before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's Project Manager of long lead time items.
- B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's Project Manager.
- C. Submit and receive approval shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

- A. See Division 26 and Section 27 05 00 for requirements and more information.

3.05 EQUIPMENT INSTALLATION

- A. Equipment to be wired and installed per manufacturer's instructions.
- B. The Contractor shall coordinate with the District's IT Department if connecting to their network.

- C. Installation shall be in accordance with applicable codes (i.e. NEC, NFPA 72) local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- D. Perform all Work as indicated on the approved Shop Drawings, Design Documents and Specifications.
- E. All low voltage cables shall be kept away from power circuits.
- F. Contractor shall provide programming and configuration each audio-visual system.
- G. Cables/wire shall be installed in a neat and orderly manner. Loose cables/wires shall be bundled and wrapped with Velcro.

3.06 LABELING/SCHEDULES

- A. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).
- B. Cables shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e. junction boxes, ground boxes, MDF, IDF, etc.) and as they enter or exit and conduit pathway.

3.07 CONFIGURATION

- A. All equipment to be fully configured and tested for functionality prior to testing.

3.08 FIELD QUALITY CONTROL AND TESTING

- A. The installation contractor will fine tune and test the systems for optimal audio and visual performance.
- B. Multi Purpose Room Audio System:
 - 1. Frequency Response: ± 3 dB per octave band, 125 Hz to 10,000 Hz. 3dB per octave roll off below 125 Hz and above 10 kHz.
 - 2. Total Acoustical Harmonic Distortion: Less than 2% at 85 dBC (1kHz reference) at four feet (1,220mm) above finished floor in the middle of the room.
 - 3. Adjust the gain structure for all audio system components (mixer input to amplifier output) to achieve the highest signal-to-noise ratio, 75 dB from 50 Hz to 15 kHz minimum.
 - 4. Ensure that the audio frequency response of the electronics system with equalizers bypassed varies less than ± 1 dB from 50 Hz to 12 kHz.

5. The electronic system audio distortion shall be less than 0.5% at 1 kHz at the equipment's rated input signal level.
 6. Sound Output Capability: Provide program levels of not less than 95 dB and speech reinforcement levels of not less than 85dB in the seating area without objectionable distortion, rattles, or buzzes, employing as test signals several different samples of recorded music and microphones applied at each system input.
 7. Hum and Noise: Hum and noise shall be inaudible (below the background noise level of the space) under normal operation and as observed in normal seat locations.
 8. Manufacturer-provided speaker tuning and limiting presets shall be utilized in the programming of the amplifier.
- G. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
 - H. Submit the Record Drawings (as-builts) to District for review prior to inspection.
 - I. During the formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to inspect wiring, devices, and system operation.
 - J. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
 - K. Notify the District when ready to perform a re-inspection of the installation.
 - L. District or its representative to provide final sign-off for acceptance.

3.09 AS-BUILT DRAWINGS

- A. See section 27 00 00 for requirements.
- B. As-built drawings shall be provided for this section.

3.10 TRAINING

- A. The Contractor shall create quick start guides customized to the specific system being installed at each location. Quick start guides shall be prepared in advance of all training sessions so they can be distributed and reviewed with staff at time of initial training. All quick start guides shall be laminated.

- B. The contractor shall make a video recording of all training sessions and export to digital medium (USB Drive) for district archive.
- C. The Contractor shall provide 1-2 hours of training for all classroom, office and conference room installations.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MANUFACTURER	PART NUMBER
Classrooms		
Touch Displays, 65", for offices and smaller conf. rooms: i. Display ii. Display monitor wall bracket	i. Newline ii. Peerless	i. TT-6521Q ii. PA762
Touch Displays, 75", for larger conf. rooms: i. Display ii. Display monitor wall bracket	i. Newline ii. Peerless	i. TT-7521Q ii. PA762
Touch Displays, 86", for classrooms: i. Display ii. Mobile Cart iii. Mobile Cart Required Accessories iv. Assistive Listening Components, see Section 27 51 26	i. Newline ii. BalanceBox iii. BalanceBox	i. TT-8621Q (with Wi-Fi module) ii. eBox II (487A11011) iii. 481A70 481A89 481A92
Multipurpose Rooms / Gymnasiums		
Rack, Wall Swing	Middle Atlantic	SR-40-28
Rack Drawer	Middle Atlantic	D3
Video Switcher	Extron	60-1570-12
10" Wall Mount Touch Screen	Extron	60-1566-02
HDMI over Catx Transmitter (Decora)	Extron	60-1741-52
Projector	Epson	EB-PU2213B
Projector wall mount with cage	BMS	CTAWA-PROJ PRO COMBO
Projector Screen	Da-Lite	21867L
4K Blu-Ray Player	Tascam	BD-MP4K
Audio DSP	Allen Heath	AHM-32
Amplifier	Powersoft	Quattrocanali 4804 DSP
PA Speaker	Fulcrum	DX1265
Wireless Microphone Receiver	Shure	ULXD4D
Wireless Microphone Transmitter	Shure	ULXD2/B87A
Wireless Microphone Antenna	Shure	UA864US

AUDIO-VISUAL SYSTEMS**27 41 00 - 10**

Power Sequencer	Furman	CN-2400S
XLR Female Decora	RDL	D-XLR3F
XLR Dual Female Decora	RDL	D-XLR2F
XLRF and 3.5MM Decora	RDL	D-J3M
XLR Male Decora	RDL	D-XLR3M
Assistive Listening Components	See Section 27 51 26	

END OF SECTION

SECTION 27 51 26
ASSISTIVE LISTENING SYSTEMS

PART I - GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, wire, installation, configuration, and testing requirements for a complete and operable Assistive Listening system. The system shall be provided in each assembly area, including conference and meeting rooms, in accordance with ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010 section(s) 216.10, 219, 706, and CBC section(s) 11B-216.10, 11B-219, 11B-706.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Assistive Listening system to the District.
 2. The contractor will coordinate with the District in writing for any needed information (i.e. IP addresses, etc.) at least 2 weeks prior to date the information is needed.
- B. The Assistive Listening System shall be FM (72 MHz) for large venue systems, and IR for classroom and portable systems.
- C. Assistive Listening equipment: Includes, but is not limited to:
- a. Transmitters
 - b. Receivers
 - c. Earpiece/Neck loops
 - d. Chargers
 - e. Signs
- D. Typical installation includes a transmitter with audio source input or microphone and portable rechargeable receivers with either neck loops or earpieces.
- E. Permanently installed assistive-listening systems are required in areas if (1) they accommodate at least 50 persons or if they have audio-amplification systems, and (2) they have fixed seating. If portable assistive-listening systems are used for conference or meeting rooms, the system may serve more than one room. An adequate number of electrical outlets or other supplementary wiring necessary to support a portable assistive-listening system shall be provided.

- F. The minimum number of receivers to be provided shall be equal to 4 percent of the total number of seats, but in no case less than two. Twenty-five percent minimum of receivers provided, but no fewer than two, shall be hearing aid compatible.
- G. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neck loops.
- E. Classroom assistive listening systems shall be fully integrated with the classroom audio-visual system or mobile TV cart such that program audio is provided via the assistive listening system.

1.03 RELATED REQUIREMENTS

- A. Division 01 – General Requirements
- B. Section 27 00 00 - Communications
- C. Section 27 05 00 – Common Work Results for Communication Systems.
- D. Section 27 10 00 – Structured Cabling

1.04 REFERENCES

- A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

- A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing A-V system

1.07 SUBMITTALS

- A. See section 27 00 00 for requirements.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.
- B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

- A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- B. Five (5) years' experience installing Assistive Listening/AV equipment systems.

1.10 CERTIFICATIONS

- A. See section 27 00 00 for requirements.

1.11 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.
- F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manufacturers – The District has standardized on Listen Technologies.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The contractor shall provide all components needed for complete and satisfactory installation and operation.
- D. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
 - 2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

- A. See Appendix A at the end of this document for pre-approved materials.
- B. Substitutions require proof of equivalence and prior approval by District and/or its representative before ordering.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing electronic assistive listening equipment before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's Project Manager of long lead time items.
- B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's Project Manager.
- C. Submit and receive approval for shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

- A. See Division 26 and Section 27 05 00 for requirements and more information.
- B. Existing Construction:
 - 1. Refer to design documents.
 - 2. Surface raceway and components shall be Wiremold 2300.

3.05 EQUIPMENT INSTALLATION

- A. Equipment to be wired and installed per manufacturer's instructions.

- B. BASE TRANSMITTER (provide 1 for each permanent sound system).
 - 1. Provide base transmitter with rack mount kit. Install where specified in the sound equipment rack and connect to content source.
 - 2. Install antenna where specified and cabling from the Base Transmitter to the antenna location.
 - 3. Program the transmitter to an interference-free transmit frequency in coordination with any adjacent systems

- C. RECEIVERS (provide a quantity equal to or greater than 4% of the total number of seats, but in no case less than 2)
 - 1. Install rechargeable batteries, if applicable
 - 2. Program receivers to the broadcast frequency of the Base Transmitter

- D. SIGN
 - 1. Provide Assistive Listening System sign per ADA requirements to indicate equipment available for the hearing impaired. Verify location with the architect prior to installation. Submit sample for approval. The sign shall include wording that states "Assistive-Listening System Available" and shall be posted in a prominent place at or near the assembly area entrance, or ticket booth window as applicable. Verify location with architect prior to installation. Assistive listening signs shall include the International Symbol of Access for Hearing Loss.

- E. PORTABLE SYSTEMS
 - 1. Contractor shall provide programming and configuration for each Assistive Listening System portable system to ensure interference-free operation between adjacent systems.

3.06 LABELING/SCHEDULES

- A. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).

- B. Cables shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e. junction boxes, ground boxes, MDF, IDF, etc.) and as they enter or exit and conduit pathway.

3.09 CONFIGURATION

- A. All equipment to be fully configured and tested for functionality prior to testing.

3.10 FIELD QUALITY CONTROL AND TESTING

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify the District when ready to perform a re-inspection of the installation.
- F. The District or its representative to provide final sign-off for acceptance.

3.11 AS-BUILT DRAWINGS

- A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Portable ListenIR System	Listen Technologies	LS-88-01
Multi Purpose Room Components:		
Assistive Listening Base Transmitter (72MHz)	Listen Technologies	LS-800-072-01
Receivers (72 MHz)	Listen Technologies	LR-4200-072
Ear Speaker	Listen Technologies	LA-401
Neck Loop	Listen Technologies	LA-430
Universal Antenna Kit	Listen Technologies	LA-122
Universal Rack Mounting Kit	Listen Technologies	LA-326
Assistive Listening Notification Signage Kit	Listen Technologies	LA-304
RG-8 50 ohm Coaxial Cable	Listen Technologies	LA-113
RG-8 BNC connector	Listen Technologies	LA-128
12 unit charging tray	Listen Technologies	LA-381
3U rack drawer	Middle Atlantic	D3
TV Cart Components:		
Assistive Listening Base Transmitter (IR)	Listen Technologies	LT-82
Assistive Listening IR Radiator	Listen Technologies	LA-140
Assistive Listening Receiver (IR)	Listen Technologies	LP-41-IR
Wireless Microphone Receiver	Shure	SLXD4
Wireless Microphone Transmitter	Shure	SLXD4
Lavalier Microphone	Shure	WL185
Rechargeable Lithium Ion Battery	Shure	SB903
Lithium-Ion Battery Charger	Shure	SBC10-903

END OF APPENDIX

END OF SECTION

SECTION 28 10 00
ACCESS CONTROL SYSTEM

PART I - GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable electronic Access Control system. The system shall provide electronic access to secure doorways to authorized persons at authorized time of day.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Access Control system to the District.
 2. The contractor will coordinate with the District in writing for any needed information (i.e. IP addresses, etc.) at least 2 weeks prior to the date the information is needed.
 3. Access Control software and equipment: Includes, but is not limited to:
 - a. Software based system for user authentication and system control
 - b. RFID cards/fobs
 - c. RFID readers
 - d. Door controllers
 - e. Power supplies
 - f. Electrified door hardware/latches/strikes
 - g. Door position switches
 - h. Power transfer hinges/armored loops
 - i. Request to exit (REX) devices
 - j. RFID badge printer (optional)
 4. Typical installation includes software, door controller, card reader, door sensor, request to exit (REX) sensor and a surface mounted electric strike designed to accommodate existing panic hardware. For doors with electrified lockset have bored doors and electric power transfer hinges see section (08 71 00 – Door Hardware for more information).
 5. All installations with network connectivity shall utilize District's network and be managed by the District's Avigilon ACM Enterprise system.

6. Access control hardware shall continue to fully function in the event of communication loss to the central server.
7. Power to control panels shall be hardwired in conduit.
8. All door controllers shall have battery backup.

1.03 RELATED REQUIREMENTS

- A. Division 01 – General Requirements
- B. Section 08 71 00 – Door Hardware
- C. Section 27 00 00 - Communications
- D. Section 27 05 00 – Common Work Results for Communication Systems.
- E. Section 27 10 00 – Structured Cabling
- F. Americans with Disability Act (ADA)

1.04 REFERENCES

- A. See section 27 00 00 for requirements.

1.05 DEFINITIONS

- A. See section 27 00 00 for requirements.

1.06 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing Access Control systems and integrate into the Districts Avigilon ACM Enterprise installation.

1.07 SUBMITTALS

- A. See section 27 00 00 for requirements.

1.08 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.

- B. Shop drawings are required for this section.

1.09 QUALIFICATIONS

- A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- B. Five (5) years' experience installing communications equipment systems.

1.10 CERTIFICATIONS

- A. See section 27 00 00 for requirements.

1.11 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.
- F. Contractor shall be responsible for scheduling Subcontractors in a timely fashion.

1.12 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

1.13 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manufacturers - See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.
- D. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
 - 2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

- A. See Appendix A at the end of this document for pre-approved materials.
- B. Substitutions require proof of equivalence and prior approval by District and/or its representative before ordering.
- C. Whenever possible and required the request to exit functionality shall be integrated into the door hardware.
- D. Electrified latch hardware shall be compatible with panic hardware and be "rim" style.
- E. Panel cabinets shall have key locks.
- F. The contractor shall furnish at least 100 RFID cards serialized per the District's standards. Middle Schools and High Schools to receive 200 RFID cards.

2.03 EXTRA STOCK

A. For each increment of 100 controlled doors furnish:

1. Quantity 5 of current model door controller.
2. Quantity 7 of current model card reader.

PART 3 - EXECUTION**3.01 ACCEPTABLE INSTALLERS**

- A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing electronic access control equipment before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the District's Project Manager of long lead time items.
- B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the District's Project Manager.
- C. Submit and receive approval shop drawings prior to work commencement.

3.04 PATHWAY INSTALLATION

- A. New Construction:
 - 1. Install 3/4" EMT in wall from hollow door frame to double-gang mud-ring and deep 4" Sq. back box on interior latch side above door frame at 96" AFF to top of box to accessible ceiling space or continuous conduit to nearest IDF.
 - 2. Install on the exterior latch side of the door a single-gang mud-ring and back box for exterior card reader at 48" AFF to top of box. Route EMT conduit to above door 4"-Sq. j-box.
- B. Existing Construction:
 - 1. Refer to design documents.

2. Surface raceway and components shall be Wiremold 2300.

3.05 EQUIPMENT INSTALLATION

- A. Power supplies and electric strike to use 24VDC and 16AWG wire.
- B. Power supplies shall be centrally located in the nearest MDF/IDF.
- C. Equipment to be wired and installed per manufacturer's instructions.
- D. Door controllers to be installed in nearest MDF/IDF unless noted otherwise on design documents.
- E. Devices requiring POE power shall be connected to a POE switch in the nearest MDF/IDF data rack – verify with Electronics/Lock Shop for available PoE.
- F. All wiring in enclosure shall have 12" minimum service loop for troubleshooting/repairs.
- G. All shielded wiring to have shields grounded at the upstream end only. Floating shields is strictly prohibited.
- H. Data drops to be installed inside the controller panel cabinet.

3.06 LABELING/SCHEDULES

- A. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).
- B. Device ID Labels are to be 1/4" lettering for mounting heights 10' AFF or less, 1/2" black lettering on white labels for mounting heights greater than 10' AFF.
- C. Access Control Panel/Cabinet label – Panel ID on exterior top right of panel door.
- D. Battery label – Install date.
- E. Wiring label – Panel ID-Panel Schedule-Door ID.
- F. Network Information label – MAC and IP address on interior top right of panel door.
- G. Network Cable Termination label - MDF/IDF-port number.
- H. Reader/Door schedule – A reader/door schedule and location drawing shall be printed and installed in a plastic sleeve inside the panel cover door.

3.09 CONFIGURATION

- A. Program all network equipment with network IP address information obtained from Electronics/Lock Shop.
- B. All equipment to be fully configured and tested for functionality prior to testing.

3.10 FIELD QUALITY CONTROL AND TESTING

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify the District when ready to perform a re-inspection of the installation.
- F. District or its representative to provide final sign-off for acceptance.

3.11 AS-BUILT DRAWINGS

- A. See section 27 00 00 for requirements.
- B. As-built riser diagram showing all access control components for site.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Door Controller (1-door)	Avigilon	AC-MER-CONT-LP1501
Door Controller (2-door)	Avigilon	AC-MER-CONT-LP1502
Door Controller (1-door/slave PoE)	Avigilon	AC-MER-CON-MR62E
2-Reader Interface Module	Avigilon	AC-MER-CON-MR52
Card Reader, (OSDP version)	Schlage	MT15, (MT15-485)
Card Reader/Mullion, (OSDP version)	Schlage	MT11, (MT11-485)
Power Supply/Cabinet (2 Door)	Avigilon	AC-LSP-2DR-MER-LCK
Power Supply/Cabinet (8 Door)	Avigilon	AC-LSP-8DR-MER-LCK
Video Intercom	Avigilon	3.0C-H4VI-RO1-IR
Electronic Surface Strike (rim style)	Assa Abloy/HES	9600
Electronic Surface Strike (rim style)	Von Duprin	6300
Electronic Latch Set (mortise)	Schlage	ND96EUPD
Latch Retraction Motor (Von Duprin)	Von Duprin	QEL
Power Transfer	Von Duprin	EPT-10
Door Position Switch	George Risk Industries, Inc.	195-12WG
Battery 12VDC, 8AH	ELK, Powersonic	ELK-1280, PS-1280
Proximity Cards	Schlage	8543 - Serialized per District Requirements Via Schlage CardTrax
Armored Door Loop	SDC	PT-3/8

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 01 57 13, Erosion Control
4. Section 31 23 33, Trenching and Backfilling.
5. Section 32 12 00, Asphalt Concrete Paving.
6. Section 32 16 00, Site Concrete.
7. Section 32 80 00, Irrigation.
8. Section 32 90 00, Landscaping.
9. Section 33 40 00, Site Drainage.

1.02 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.03 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered

in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.

- D. Tests (See Part 3 for Compaction Testing).
- E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.04 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.05 REFERENCES AND STANDARDS

- A. General: Site survey, included in the drawings, was prepared by Warren Consulting Engineers and is the basis for data regarding current conditions. While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.
- B. Geotechnical Engineering Report was prepared by Raney Geotechnical Inc. Report is entitled Hollywood Park Elementary School Pavement Improvements, File No. 3073-003.00P and is on file with Architect. Recommendations of the Geotechnical report were used to develop the contract plans and specifications. The Geotechnical report shall be used as a reference for the soil condition of the project site. The design information contained in the contract plans and specifications shall govern over the recommendation of the Geotechnical report.
- C. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.
- D. ANSI/ASTM D698-e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- E. ANSI/ASTM D1556-e1 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- F. ANSI/ASTM 698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- G. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- H. ANSI/ASTM D 4318-10e1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- I. CALTRANS Standard Specifications Section 17.
- J. CAL-OSHA, Title 8, Section 1590 (e).
- K. Any work within the street, highway or right-of-way shall be performed in accordance with the

requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.08 EXISTING SITE CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.09 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

- A. Ground-breaking requirements:
 - 1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
 - 2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.
- B. Underground Utility Locating:
 - 1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
 - 2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience.
 - 3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.

4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72”.
5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
 - a) All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
 - b) All conduit pathways containing an active cable TV system.
 - c) All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
 - d) All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
 - e) All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
 - f) All plastic and other nonconductive water lines in which a TransOnde Radio detection) or other “transmitter” can be applied to create a low frequency pressure wave (signal) without damaging or triggering the existing systems.
 - g) All copper or steel waterlines and plastic or steel gas lines
6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional charge.
9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
10. Contractor shall inform the (District’s Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

1.10 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid

creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

1.11 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.12 TESTING

- A. General: Refer to Section 01 45 00 – Quality Requirements.
- B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
 - 1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
 - 2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

1.13 ARCHEOLOGICAL AND CULTURAL RESOURCES

- A. If archeological or cultural resources are discovered during the Work, the Contractor must cease all construction operations in the vicinity of the discovery until a qualified archeologist can assess the value of these resources and make recommendations to the State Historic Preservation Officer. Archeological and cultural resources include artifacts, large amounts of bone, shell, or flaked stone, and other evidence of human activity. If the State Historic Preservation Officer or the Owner directs that work be temporarily ceased at the location of an archeological or cultural find, the Contractor must temporarily suspend work at the location.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if

necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction. Clods, rocks, hard lumps or cobbles exceeding 3-inches in final size shall not be allowed in the upper 12 inches of any fill.

B. Imported Engineered Fill Material: Imported fill may be required to complete work. Proposed import fill material shall meet the above requirements; shall be similar to the native soils. Import fill shall meet the above requirements; shall have plasticity index of 12 or less; an Expansion Index of 20 or less; be free of particles greater than 3-inches in largest dimension; be free of contaminants and have corrosion characteristics within the acceptable limits. All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site. Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

1. DTSC TESTING: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the contractor.
2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory (http://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.
Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
3. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows;

Fill Material Sampling Schedule

Area of Individual Borrow Area	Sampling Requirements
2 Acres or less	Minimum of 4 samples
2 to 4 Acres	Minimum of 1 sample every ½ Acre
4 to 10 Acres	Minimum of 8 Samples
Greater than 10 Acres	Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile

Up to 1,000 Cubic Yards	1 sample per 250 cubic yards
1,000 to 5,000 Cubic Yards	4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards
Greater than 5,000 Cubic Yards	12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

4. Reports/ Documentation

- a. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.
- C. Landscape Backfill Material:
1. The top 3" of native topsoil stripped from the site may be used for landscape backfill material provided it meets the requirements as specified in Section 329000.
 2. Imported Topsoil may be required to complete work. See Section 329000 for requirements. Proposed Topsoil material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.
- D. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.
- E. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

PART 3 – EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PERFORMANCE

A. GENERAL:

1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density

determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.

4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.03 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

- A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to 2% above optimum moisture content, and recompacted to at least 90% of the maximum dry density.

3.04 TESTING AND OBSERVATION

- A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.
- B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.
- C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.
- D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.
- E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.05 CLEARING AND GRUBBING

- A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. Holes resulting from tree and brush removal should be prepared and backfilled in accordance with paragraphs 3.07, 3.08, 3.09, and 3.10. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics. Stripping's meeting the requirements of Section 32 90 00 may be used in landscape areas only.

3.06 CUTTING

- A. Do all cutting necessary to bring finish grade to elevations shown on Drawings.
- B. When excavation through roots is necessary, cut roots by hand.

- C. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

3.07 STRUCTURAL EXCAVATION

- A. Unsuitable Ground: Any errors in structural excavation, soft ground, or clay soils found when excavating shall be reported to Architect. In no case shall work be built on any such soft or clayey unsuitable surface without direction from the Architect. Restore excavations to proper elevation with engineered fill material compacted to 90% of dry density.

3.08 SUBGRADE PREPARATION

- A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.
- B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 12", until surface is free from ruts, hummocks or other uneven features and uniform and free from large clods. Moisture condition to 2% above optimum moisture content and recompact to at least 90% of the maximum dry density as determined by ASTM Test Method D1557. If the existing soils are at a water content higher than specified, the contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.
- C. Subgrade in areas to receive landscaping shall be compacted to 90%.
- D. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.09 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN BUILDING PAD AND PAVEMENT AREAS

- A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content.
- B. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.
- C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 90% as determined by the ASTM D1557 Compaction Test. Compact each layer over its entire area until desired density has been obtained.

- D. Recomposition of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6", moisture conditioned to 2% above optimum moisture content, and compact to a minimum of 90% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.
- E. Jetting of fill materials will not be allowed.

3.10 FINAL SUBGRADE COMPACTION

- A. Paved Areas: Upper 12" of all final subgrades supporting pavement sections and all other flatwork shall be brought to specified moisture content and shall be uniformly compacted to not less than 90% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
- B. Other Fill and Backfill: Upper 12" of all other final subgrades or finish grades shall be compacted to 90% of maximum dry density.
- C. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.11 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

- A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 12" at 85% of maximum dry density.
- B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.12 SLOPE CONSTRUCTION

- A. Cut slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Fill slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Prior to placement of fill on an existing slope the existing slope shall be benched. The benches shall be in a ratio of 2 horizontal to 1 vertical. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.13 FINISH GRADING

- A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be "flat graded" to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be +0.05'. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.

- B. All landscape areas shall be left free of rock or foreign material as specified in Section 32 90 00.
- C. All landscape areas shall be approved by Architect prior to any planting.

3.14 SURPLUS MATERIAL

- A. Excavated material not required for grading or backfill shall be removed from site at contractor's expense.

3.15 CLEANING

- A. Refer to Section 01 74 00.
- B. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION

SECTION 31 13 16

TREE PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Tree protection complete as shown and as specified.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 00 00 00 – Site Demolition.
3. Section 32 80 00 – Irrigation.
4. Section 32 90 00 – Landscaping.

1.02 SUBMITTALS

A. Contractor shall submit Tree Protection Area plan to Architect outlining all trees and plants listed by number to be protected and their groupings. All trees and plants shall be grouped in their own Fenced Tree Protection Areas as shown in Drawings.

B. Contractor shall submit to Landscape Architect in writing a schedule including any and all activity inside Fenced Tree Protection Areas. This schedule to include but not limited to the dates fences are initially installed, altered and dates of fence replacement. Intent of these provisions is that the Tree Protection Zone (TPZ) are fenced for the entire duration with only exceptions of short intervals or specifically defined construction activity needs. Revise schedule as directed by Architect.

C. Provide a Mediation Plan to keep existing trees and planting irrigated during construction.

1.03 WARRANTY

A. Guarantee all workmanship and materials hereunder against defective workmanship and materials, including damage by leaks and settlement of irrigation trenches, for the duration specified in Division 01 of these Specifications. (The Contractor is not responsible for vandalism or theft after date of final acceptance.)

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use materials as specified; any deviation from the Specifications must first be approved by the Owner's Representative in writing. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.
- B. Trunk Protection constructed of:
 - 1. 20-foot long 2x6 wood boards or length needed to protect the trunk if tree trunk is shorter than 20'.
 - 2. Metal wire. Gauge strong enough to tie the boards around the trunk of the tree.
- C. Tree Protection Zone Fencing:
 - 1. 4-foot-tall snow fencing or 6-foot-tall metal chain link construction fencing per the discretion of the Landscape Architect or District Representative.
- D. Bark Mulch: Untreated, shredded cedar.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Maintain pre-existing moisture levels.
- B. Maintain areas inside the fenced tree protection area including lawn mowing, leaf removal, operation and repair of irrigation.
- C. Protect root systems from flooding, erosion, excessive watering and drying resulting from dewatering or other operations:
- D. Prohibitions - DO NOT:
 - 1. Allow run off or spillage of damaging materials in vicinity of root systems,
 - 2. Rinse tools or equipment under trees,
 - 3. Store materials, stockpile soil, park or drive vehicles within drip lines or in areas with plants,
 - 4. Cut, break skin or bark, bruise roots or branches,
 - 5. Allow fires under and adjacent trees and plants,
 - 6. Discharge exhaust under foliage,
 - 7. Secure cable, chain or rope to trees,
 - 8. Change grade within drip line of trees without Landscape Architect's approval,
 - 9. Lime shall not be used.

3.02 INSTALLATION

A. Tree Trunk Protection

1. Conform to requirements for trees and plants to be retained, per 3.01, above.
2. Install boards vertically around tree and bind together with wire to protect the bark 360 degrees around the entire tree prior to start of any demolition and construction. Boards are not to dig into bark.
3. Major scaffold limbs may require plastic fencing or straw waddles to be wrapped around them to protect them.

B. Tree Dripline Protection

1. The Tree Protection Zone (TPZ) is a restricted area around the base of the tree with a radius of one foot (1') for every inch of tree trunk diameter or ten feet, which is greater, enclosed by tree protection zone fencing.
2. Signage designating the protection zone and penalties for violations shall be secured in prominent location on each protection fence.

C. Requirements for Trees to be Protected

1. Duration: Tree protection shall be erected before demolition, grading, or any construction begins and remain in place until final inspection of the project.
2. Conform to requirements for trees and plants to be retained, per 3.01, above.
3. Architect shall give final review of Tree Protection before construction to begin. Revise schedule as directed by Architect.
4. Vehicle movement within the TPZ will only be allowed for construction equipment.
 - a. Within dripline, apply 10-inch layer of mulch over geotextile fabric.
5. Perform trenching operations within the TPZ of the tree so that:
 - a. Digging shall be by hand using narrow trenching shovel,
 - b. No roots larger than 2" diameter are cut and utilities are routed around or below them,
 - c. Roots smaller than 2" diameter are cut with sharp tools, saws, loppers- not torn, chopped or broken.
6. Where roots are exposed:
 - a. Do not allow the roots to dry out,
 - b. On the same day the excavation is made, provide temporary backfill to original grade at tree roots,
 - c. Or cover roots with 4 layers of wet untreated burlap, made wet each day, including weekends.
7. Roots larger than 3" in diameter are not to be cut without review and approval of Arborist.

3.03 REPAIR/RESTORATION:

- A. It shall be the responsibility of Contractor to repair or replace any damaged trees.

- B. Repair trees damaged by operations:
1. within 24 hours of damage,
 2. to satisfaction of Landscape Architect,
 3. to ISA Pruning Standards.
- C. Replace repaired trees where repair has not restored them to health or aesthetics:
1. within 6 months of request to replace,
 2. to the satisfaction of Landscape Architect,
 3. with replacement plants of a size and variety matching those that were removed,
- D. Replaced trees and plants shall be the responsibility of Contractor to maintain in good health and aesthetics for the duration of the project from installation.
1. Contractor shall submit to Landscape Architect comprehensive maintenance plan for replacement tree, including but not limited to provisions for irrigation system independent of existing system.
- E. Where suitable replacement of trees and plants are not available:
1. Contractor shall provide affidavits to Landscape Architect that they are not available.
 2. Contractor shall provide compensation to the State at the following rates:
 - a. \$2000 for each caliper inch of any tree or plants removed under 12 inches.
 - b. \$4000 for each caliper inch of any tree or plants removed 12 inches or more.
 - c. Caliper of trees and plants measured at 6 inches above grade.
 - d. Caliper defined here as thickness of diameter, measured in inches.
- F. Soil Contamination:
1. Contractor shall remove soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at Contractor's expense.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 01 57 13, Erosion Control
4. Section 31 23 33, Trenching and Backfilling.
5. Section 32 12 00, Asphalt Concrete Paving.
6. Section 32 16 00, Site Concrete.
7. Section 32 80 00, Irrigation.
8. Section 32 90 00, Landscaping.
9. Section 33 40 00, Site Drainage.

1.02 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. Contractor / Installer shall have been in business for five (5) years providing/finishing similar size projects and complexity.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Submit Manufacturers data and shop drawings.

1.04 WARRANTY

- A. Submit fully executed warranty for work and materials in this section per 01 78 36.

1.05 REFERENCES AND STANDARDS

- A. California Building Code 2022 current edition.
- B. California Plumbing Code 2022 current edition.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Contractor shall acquaint himself with all existing site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Field verify that all components, backing, etc. by others are installed correctly to proceed with installation of products as herein specified.
- C. Trench dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for trench dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.08 PROTECTION

- A. Adequate protection measures shall be provided to protect workers and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations. Repair all trenches in grass areas with new sod (seeding not permitted) and "stake-off" for protection.
- B. Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Architect or Owner is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullyng of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. Keep all excavations free from water during entire progress of work, regardless of cause, source or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.
- H. Trees: Carefully protect existing trees which are to remain.

1.09 TRENCH SAFETY PROVISIONS

- A. General Contractor shall be solely responsible for safety design, construction and coordination with agencies having jurisdiction. If such plan varies from shoring system standards established by Construction Safety Orders, plan shall be prepared by registered civil or structural engineer.
- B. Nothing herein shall be deemed to allow use of shoring, sloping or protective system less effective than that required by Construction Safety Orders of California State Division of Industrial Safety.
- C. When trenching through paved surface, provide steel trench plates to cover open trenches daily until trenches are backfilled.

1.10 SEASONAL LIMITS

- A. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, full operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Material above optimum moisture shall be processed per section 310000, 3.08, B.

1.11 TESTING

- A. General: Refer to Section 01 45 00 – Quality Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Backfill materials: Pipeline and conduit trench backfill as shown on the plans and as specified below.
 - 1. ¾ inch crush rock.
 - 2. Native Materials: Soil native to Project Site, free of wood, organics, and other deleterious substances. Rocks shall not be greater than 3-inches.
 - 3. Sand: Fine granular material, free of organic matter, mica, loam or clay.
 - 4. Lean Mix Concrete/Controlled Density Backfill: 2 sacks cement slurry.
 - 5. Class 2 aggregate base, ¾" rock, per Caltrans section 26-1.02B
- B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.
- C. Provide other bedding and backfill materials as described and specified in Section 31 00 00, Section 33 40 00 and Divisions 15 and 16.

PART 3 – EXECUTION**3.01 INSPECTION****A. Verification of Conditions:**

1. Examine areas and conditions under which work is to be performed.
2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.

3.02 COORDINATION

- A. General Contractor shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.03 INSTALLATION

- A. Perform work in accordance with pipe manufacturer's recommendations, as herein specified and in accordance with drawings.

3.04 TRENCHING

- A. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of trench around installed item as required for caulking, joining, backfilling and compacting; not less than 12 inches wider than pipe or conduit diameter, unless otherwise noted.
- B. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.
- C. Trench straight and true to line and grade with bottom smooth and free of edges or rock points.
- D. Where depths are not shown on the plans, trench to sufficient depth to give minimum fill above top of installed item measured from finish grade above the utility as follows:
1. Sewer pipe: depth to vary
 2. Storm drain pipe: depth to vary
 3. Water pipe - Fire Supply: 36 inches
 4. Water pipe – Domestic Supply: 30 inches
- E. Where trench through existing pavement saw cut existing pavement in straight lines. Grind existing asphalt on each side of trench 3" wide x ½ the depth of the section. Apply tact coat to vertical surfaces before installing new asphalt. Replace asphalt and concrete pavement sections to matched existing conditions. In concrete pavement provide expansion and control joints to match existing joint layout.

3.05 BACKFILL

- A. Pipe Trench Backfill is divided into three zones:
1. Bedding: Layer of material directly under the pipe upon which the pipe is laid.
 2. Pipe Zone: Backfill from the top of the bedding to 6 inches (compacted) over the top of the pipe.
 3. Upper Zone: Backfill between top of Pipe Zone and to surface of subgrade.
- B. Bedding: Type of material and degree of compaction for bedding backfill shall be as defined in the Details and Specifications.
- C. Pipe Zone and Upper Zone Backfill:
1. Type of material and degree of compaction Pipe Zone and Upper Zone Backfill shall be as required by Drawings, Details, & Specifications.
 2. Upper Zone Backfill shall not be placed until conformance of Bedding and Pipe Zone Backfill with specified compaction test requirements has been confirmed.
 3. Backfill shall be brought up at substantially the same rate on both sides of the pipe and care shall be taken so that the pipe is not floated or displaced. Material shall not be dropped directly on pipe.
- D. Backfill Compaction:
1. Backfill shall be placed in layers which, when compacted shall not exceed 6 inches in thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity. Do not backfill over, wet, frozen or soft subgrade surfaces. Employ a placement method that does not disturb or damage foundation walls, perimeter drainage, foundation damp-proofing, waterproofing or protective cover.
 2. When moisture content of fill material is below that required to achieve specified density, add water until proper moisture content is achieved. When moisture content is above that required, aerate by blading or other methods until specified moisture content is met, see section 310000, 3.08, B.
 3. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to 90% of maximum dry density while at specified moisture content. Compact each layer over its entire area until desired density has been obtained.
 4. The top 12 inches of subgrade compaction under pavement or building shall be per Earthwork section 31 00 00.
 5. Compaction: All backfill operations shall be observed by the Inspector of Record and/or Geotechnical Engineer. Field density tests shall be made to check compaction of fill material. If densities are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified densities. Notify Inspector and Architect at least 24 hours in advance of any operation.
- E. Backfill in Areas Previously Lime or Cement Treated
1. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base, with minimum section equal to the lime treated section and compacted to 95%.

3.06 TRENCH AND SITE RESTORATION

- A. Finished surface of trenches shall be restored to a condition equal to, or better than the condition as existed prior to excavation work.

3.07 PROTECTION

- A. Protect existing surfaces, structures, and utilities from damage. Protect work by others from damage. In the event of damage, immediately repair or replace to satisfaction of Owner.
- B. Repair existing landscaped areas to as new condition. Replant trees, shrubs or groundcover with existing materials if not damaged or with new materials if required. Replace damaged lawn areas with sod, no seeding will be permitted.
- C. Replace damaged pavement with new compatible matching materials. Concrete walks to be removed to nearest expansion joint and entire panel replaced. Asphalt to be cut neatly and replaced with new materials.
- D. Any existing materials removed or damaged due to trenching to be returned to new condition.

3.08 SURPLUS MATERIAL

- A. Remove excess excavated material, unused materials, damaged or unsuitable materials from site.

3.09 CLEANING

- A. Refer to Section 01 74 00.
- B. Contractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others throughout the project and at the completion of work.
- C. After completion of work in this section, remove all equipment, materials, and debris. Leave entire area in a neat, clean, acceptable condition.

END OF SECTION

SECTION 32 12 00

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Asphalt paving mix designs.
2. Aggregate Base Course.
3. Asphalt Overlay.
4. Seal Coat and Striping.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 310000, Earthwork.

1.03 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.
- E. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.
- F. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.
- G. Sieve analysis from a testing laboratory identifying rock/sand percentages within the class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.05 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.06 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

- A. Environmental Requirements:

- 1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when

atmospheric temperature is below 40 degrees F.

2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
 - C. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
 - D. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
 - E. Any construction review of the Contractor's performance conducted by the owner's representative is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
 - F. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
 - G. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
 - H. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.
 - I. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.09 TESTING

- A. General: Refer to Section 01 40 00 – Quality Requirements.
- B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sterilant: Soil sterilizer shall be CIBA GEIGY's PramatoI 25-E or Thompson-Hayward Casoron.
 - 1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.
- B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).
- C. Asphalt Binder: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for HMA per Caltrans approved list of manufacturer's.
- D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.
- E. Surface Course Aggregate: Mineral aggregates for Type "B" asphalt concrete, conforming to State Specifications 39-2.02, Type B, 1/2" maximum, medium grading. 3/8" maximum grading at Playcourt.
- F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as:
 - 1. "Park-Top No. 302", Western Colloid Products.
 - 2. "OverKote", Reed and Gram.
 - 3. "Drivewalk", Conoco Oil.
- G. Wood Headers and Stakes: Pressure treated.
- H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D 6628.
 - 1. Waterborne traffic line - colors white, yellow and red, State specification PTWB-01R3.
 - 2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.
- I. Precast Concrete Bumpers: 3000 psi at 28 day minimum strength; 48" length unless otherwise indicated; provide with steel dowel anchors and concrete epoxy.
- J. Pavement Epoxy; K-Lite; KtepX-590; Ennis Epoxy HPS2 or an approved equal.
- K. Crack Filler;
 - 1. Cracks up to 1/2": QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX Trowel Grade crack filler or approved equal.
 - 2. Cracks 1/4" – 1": "Docal 1100 Viscolastic, distributed by Conoco, Inc., Elk Grove, CA, (916) 685-9253, or approved equal.
 - 3. Cracks greater than 1": Hot Mix, Topeka.
- L. Reclaimed Asphalt Pagment (RAP). HMA Type A or Type B may be produced using RAP providing it does not exceed 15% of the aggregate blend.

2.02 MIXES

- A. General: Plant mixed conforming to State Specifications, Section 39, Type B, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.
- B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.
- C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.
- D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.
- E. Temperature of Warm Mix Asphalt: Mixing and placement; Per the approved manufactures heat range recommendations for mixing and placement.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

- A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

3.02 PREPARATION

- A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.
- B. Cleaning: Existing surfaces and new surface shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation. Hose down entire area with a strong jet of water to remove all debris.

3.03 INSTALLATION

- A. Headers:
 - 1. General: Install as edging to asphalt paving, except where adjoining existing pavement, concrete curbs, walks or building.
 - 2. Existing Headers: Remove existing headers where new paving will join existing. Saw cut existing asphalt to provide clean edge.
 - 3. Lines and Levels: Install true to line and grade. Cut off tops of stakes 2-inches below top of header

so they will not be visible on completion of job.

B. Asphalt Paving:

1. Base Course: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the Architect is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.
 - a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.
2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.
3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.
4. Asphalt Concrete Surface Course:
 - a. Comply with State Specifications, 39-6 except as modified below.
 - 1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 91% of the theoretical maximum specific gravity determined by California Test Method #309. Maximum variation 1/8 inch in 10' when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.
 - 2) Asphalt material shall be delivered to the project site in a covered condition to maintain acceptable temperature. Onsite inspector shall verify temperature of asphalt upon truck arrival to the site.
5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.
6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.
7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 3" wide x 1/2 the depth of the section. Apply tack coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 2, 15 and 16.

C. Seal Coat:

1. Seal coat shall be applied no sooner than 30 days from time of asphalt placement, no exceptions.
2. Surface Preparation: surface and cracks shall be clean of all dirt, sand, oil or grease. All cracks shall be filled to a level condition after curing. Make multiple fill applications until a level condition is achieved. Failure to do so will be the reason for rejection. Hose down entire area with a strong jet of water to remove all debris. Remove soft, loose, or otherwise damaged areas of asphalt concrete to full depth of damage and replace with compacted hot mix asphalt concrete as specified herein. Minor holes and imperfections may be patched using hot mix asphalt or mastic using sand/SS-1-H. Use wire brush for removal of oil and grease; prime with shellac or synthetic resin as recommended by manufacturer of pavement sealer material.
3. Seal Coat Seal Application: Thoroughly mix materials and apply in the presence of the onsite inspector. Failure to do so will be cause for rejection. Apply in accordance with manufacturer's written instructions.
 - a. The minimum application rate for each applied coat shall be 30gals per 1000 sq. ft. Two coats of sealcoat will be required.
 - b. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.

D. Asphalt Concrete Overlay Paving:

1. Comply with State Specifications, 39-6 except as modified below.
2. Grind or remove existing asphalt concrete paving at limits of overlay paving to provide a minimum 1 1/2" overlay thickness. Limits of grinding or removal shall be field verified to insure that finished paving surface will have a one percent minimum slope.
3. Thoroughly clean surface to remove vegetation, dirt, sand, gravel and water from surface and from cracks. Vegetation shall be treated 7 days prior to removal with an herbicide.
4. Cracks greater than 1 inch shall be filled with hot mix asphalt and rolled and compacted. Cracks less than one inch shall be filled with crack filler. Potholes shall be filled with hot-mix rolled and compacted. Contractor shall have Engineer approve crack and pothole repair prior to overlay. Provide leveling courses of hot mix asphalt as required to achieve finish grades shown on the drawings.
 - a. Cracks less than one inch in width shall be level after curing. Contractor shall make multiple filling applications as necessary to achieve a level condition.
5. Place overlay when ambient air temperature is 40 degrees F. and rising, and when pavement is dry.
6. An asphalt tack coat shall be applied to existing surface area at a rate of 0.20 gallons per square yard. Application width shall be width of fabric plus 2 to 6 inches.
7. Place, spread and compact asphalt overlay to provide a minimum density of 95% of maximum theoretical unit weight as determined by California Test Method #304. Maximum variation 1/8" in 10' when measured with steel straight edge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. Minimum compacted overlay thickness 1 1/2 inches.

- E. Pavement Marking: pavement markings shall be done only after the seal coat has thoroughly dried. Existing surfaces to be striped with traffic paint shall be cleaned of dust, dirt, grime, oil, rust or other contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be thoroughly cleaned by whatever means necessary that will satisfactorily accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings,

templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer's instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playfield markings, etc. on asphalt concrete paving. Paint strips shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).

1. Paints shall be delivered to the site in unopened containers.
 - a. Paint shall not be diluted, or watered down.
 - b. Paint shall be applied in 10-12 wet mil thickness (4-6 mil dried). Each coat thickness shall be verified by the project inspector.
2. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to PMS 293C. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

F. Colors: As directed by Architect

G. Precast Concrete Bumpers: Install in location where shown, using steel rebar dowels, and epoxy.

3.04 DEFECTIVE ASPHALT;

Defective asphalt is as described below.

- A. Exposed rock pockets on the finished surface that lack the # 8- #200 fines that is required per the sieve analysis.
- B. Asphalt not placed to the design grades.
- C. Asphalt that ponds water.
- D. Asphalt that was compacted below the minimum required temperature and is cracked.
- E. Asphalt that fails to meet the minimum compaction requirements.
- F. Asphalt that lacks the minimum thickness required per plan.
- G. New asphalt contaminated by a petroleum product, or spilled paint.
- H. Asphalt that has depressions, cracks, scored divits from dumpster wheels, heavy equipment use, heavy construction products,
- I. Asphalt placed on pumping, unstable sub-grades.

3.05 CLEANING

- A. Refer to Section 01 74 00.

- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION

SECTION 32 15 00

AGGREGATE SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Crushed aggregate blended with GraniteCrete admixture surfacing
- B. Related Work:
 - 1. Section 31 00 00 – Earthwork
 - 2. Section 00 00 00 – Base Course

1.02 REFERENCES

- A. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates
- B. ASTM D2419 - Sand Equivalent Value of Soils and Fine Aggregates
- C. Caltrans Standard Specifications for Public Works Construction
- D. RIS - Redwood Inspection Services Grades of California Redwood

1.03 SEQUENCING

- A. Do not install work specified in this section prior to acceptance of earth moving. Coordinate work specified in this section with work specified in other sections to minimize cutting of - and operation of - heavy equipment over newly installed surfacing.

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures for additional requirements
- B. Manufacturer's product data sheet and installation instructions indicating that product complies with specifications for:
 - a. Crushed aggregate blended with GraniteCrete admixture surfacing
 - b. Edging
- C. Samples: Submit samples of the following materials to Landscape Architect for approval:
 - 1. Crushed aggregate with admixture in color specified: (3) one-quart zip-locked plastic bag.
 - 2. Redwood Edging: Submit evidence of chain-of-custody in accordance with Forest Stewardship Council

1.05 QUALITY ASSURANCE/FIELD QUALITY CONTROL

- A. GraniteCrete installation differs from the installation of concrete or traditional decomposed granite binders.

1. A GraniteCrete representative must be on-site at the beginning of any installation to train the crew in the procedures for achieving an excellent GraniteCrete installation. Or, GraniteCrete must sign off on the installer (in writing) prior to installation.
2. GraniteCrete offers paid consulting services in eight-hour blocks + travel.
3. The installation instructions in this Specification Guide are meant as a guide for bidding purposes and will be superseded by the approved Submittal of installation instructions from GraniteCrete, Inc., and any field direction provided by the company representative.
4. GraniteCrete, Inc. does not offer a warranty on any installation - even if completed by an Approved Installer - only on the product, bag-to-bag.

B. Porous Base Rock Testing:

1. Testing shall occur during installation at 10 ton increments of shipping for sieve conformance. Results shall be submitted prior to completion of the stone base installation.
 - a. The stone field area shall have a permeable rate no less than 14" per hour. The testing shall be per Din 8035 Part 7, ASTM 2434 (constant head), or ASTM F2898 testing methods.
 - b. In addition to the lab testing, after installation of any aggregate base cross-section, designed to conduct rainfall to the sub-soils and/or under-drain system, the finished aggregate base shall be tested, in situ for infiltration rate, using method ASTM F2898. The test shall be performed by a registered Geotechnical Engineer or certified agronomist.
2. The Contractor is responsible to meet this performance specification, before proceeding with installation, and shall bear the cost of the on-site testing and the cost of any additional work necessary to achieve compliance with the specification.
3. All test results shall be logged and documented by the Owner's Technical Representative or Geotechnical Engineer. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his expense, the processed stone base to the required grade, cross-section and density.
4. After the contractor has independently confirmed compliance with all the above tolerances (planarity and elevation verified by a licensed surveyor and compaction, gradation, & permeability verified by Geotechnical Engineer, he shall notify the appropriate party and schedule a final inspection for approval. The contractor shall make available an orbital laser system to the Inspection Team for the inspection process.
5. The compaction rate for porous base rock should be 88%. The compaction rate for non-porous base rock should be 95%.

C. Standard Specifications: Shall mean the California Department of Transportation Standard Specifications, latest active edition.

1.06 MOCK-UP

- A. Construct mockup of nine square feet minimum of crushed aggregate blended with GraniteCrete admixture surfacing, including base course and edging, at location approved by Landscape Architect. Build mockup 30 days prior to installation. Intent of the mockup is to demonstrate surface finish, texture, color and standard of workmanship
- B. Notify Landscape Architect 7 days in advance of mockup construction.
- C. Allow Landscape Architect to view and obtain approval of mock-up before proceeding with rest of crushed aggregate blended with GraniteCrete admixture surfacing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all GraniteCrete Admixture bag or bulk materials in original, unopened packaging. Protect materials and aggregate from contamination with foreign matter. Store under a waterproof cover and protect from dampness.

1.08 FIELD CONDITIONS

- A. Do not install crushed aggregate blended with GraniteCrete admixture surfacing when the sub-base is wet at saturated field capacity.
- B. Do not install GraniteCrete materials during rainy conditions or below 40 degrees Fahrenheit.

PART 2 - PRODUCTS

2.01 CRUSHED AGGREGATE BLENDED WITH GRANITECRETE ADMIXTURE SURFACING MATERIALS.

A. Acceptance Manufacturer:

- 1. Specification is based on products by GraniteCrete, Inc.
419 Webster Street, Suite 202
Monterey, CA 93940
Phone: (800) 670-0849; Fax: (800) 670-0849
www.granitecrete.com

GraniteCrete admixture is an all-natural product and does not contain oils, polymers, resins, or enzymes.

- 2. Substitutions: Products by other manufacturers that comply with specifications will be considered in accordance with Section 00 21 00 – Instructions to Bidders. Section 01 25 00 – Substitution Procedures.

B. Decomposed Granite (DG), crushed aggregate.

- 1. DG shall have a 3/8" maximum gradation, produced from naturally friable rock/granite with enough fines to produce a smooth walking surface. Materials should be free from clay lumps, organic matter, and deleterious material. Blends of coarse sand and rock dust are not acceptable.
- 2. Use a single supply source for the entire quantity required.
- 3. Gradation, in accordance with ASTM C136:
- 4. Color: Should have gold to yellow hues. To be selected by Landscape Architect from manufacturer's standard colors.
- 5. Supplier: Vineyard Rock Products, Hollister, CA. - (831) 637-6443, or equal.

- C. Aggregate binder: Provide GraniteCrete Admixture. Color: [Ash Gray] [CarmelCoast] [Desert Sand] [Natural Gold] [Sonora Adobe] [Custom Color]

2.02 BASE COURSE MATERIAL

- A. Class II Permeable Base Rock.

- B. Soft stone materials (i.e. sandstone, limestone and shale materials) are not suitable. The stone supplier shall certify that all supplied stone will be clean of this type of stone. All types of stone shall meet the following stability requirements.

TEST METHOD	CRITERIA
LA Abrasion (Calif. Test 211)	Not to exceed 40
Durability Index (Calif. Test 229)	Not less than 40

In addition, if stone stability to water and vehicles is in question, Owner has the right to perform additional testing to ensure material shall adhere to requirements of Caltrans Section 68, as well as additional applicable ASTM tests.

- C. All testing fees shall be paid for by the Contractor.
- D. Permeable Stone: Stone base materials shall be washed, 100% fractured, by mechanical means, with elongated characters on each individual particle larger than 1/4". Materials shall be devoid of mineral fines. All particles smaller than 1/4" shall be produced by manufactured means only. Rounded sands or aggregates are prohibited.
- E. Delivery Moisture Content: Processed stone shall contain 90% to 110% of the optimum moisture content to ensure that fines do not migrate in transit or during placement and to facilitate proper compaction. The contractor shall ensure that aggregate leaving the source plant meets this requirement. The contractor is required to apply water to the processed stone on site to attain and maintain this minimum moisture content.
- F. Aggregate or aggregate blends of permeable stone shall conform to the following gradation (please note this is for base rock, not for GraniteCrete):

Sieve	Sieve Sizes Metric (mm)	Percent Passing by Weight* Intended Result	Sieve Range
1"	25.0	100	100
3/4"	19.0	100	90-100
3/8"	9.52	78	40-100
No.4	4.75	36	25-40
No. 8	2.36	26	18-33
No. 30	0.600	11	5-15
No. 50	0.300	6	2-10
No. 200	0.075	2	0-5

Durability Index (CTM# 229) 40 min
 Sand Equivalent (CTM# 217) 70
 LA Rattler (CTM# 211) 500 Revs, less than or = 40%

* AASHTO Test Method T-27

- G. Specs for 3/8" minus and 3/4" minus Crushed Aggregate Following ASTM D 1140-17: Crushed aggregate must be free from contaminants that would discolor or be deleterious to crushed aggregate blended with GraniteCrete admixture surfacing.

100% fractured on all sides with no rounded particles Sieve 200 - Non-expansive Clay Fines - not to exceed 18%

The below test is for 3/8" minus stone, at approximately 90% compaction when tested.

Sieve Size	% Passing	Sieve Range
1/2"	100	100
3/4"	95	98
No. 4	85	90
No. 8	75	85
No. 16	55	70
No. 30	38	57
No. 50	24	33
No. 100	15	24
No. 200	9	18
No. 400	0	9

2.03 ACCESSORIES

- A. Water: Free from contaminants that would discolor or be deleterious to crushed aggregate blended with GraniteCrete admixture surfacing.

Installation: Do not use a vibratory plate to compact the GraniteCrete. Use a lawn roller filled with water to compact the GraniteCrete. It is highly recommended to use a volumetric truck for larger installations. If possible, screeding and the use of a paver is highly recommended.

- B. Steel Edging:
 1. Dimensions: [3/16"] [1/4"] [] thick by [4-inch] [] deep, with overlapping joints.
 2. Stakes: 3/16" x 1-3/4" wide at top tapering to point at bottom; located 36" o.c. maximum.
 3. Finish: [Baked-on [green] [brown] [black] paint.] [Hot dipped galvanized.]
- C. Redwood Edging:
 1. Material: RIS Merchantable Heart Grade from sustainably managed forests as certified by the Forest Stewardship Council.
 2. Dimensions: Nominal 2x6 inches
 3. Stakes: Steel, 3/16" x 16" long x 1-3/4" wide at top tapering to point at bottom; located 36" o.c. maximum.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine grading and subsoil conditions. Do not proceed until conditions are acceptable per the architect's specifications.

3.02 PREPARATION

- A. Excavation: Excavate to depth required so edges of crushed aggregate blended with GraniteCrete admixture surfacing will match adjacent grades and have a maximum cross slope of 1 percent. [Remove excavated soil from site.]
- B. Sub-grade Preparation: Comply with Caltrans Standard Specifications Section 301-1 – "Sub-grade Preparation."
- C. Base Course Installation: Class II permeable base rock at 90% compaction.
- D. Edging: Install flush with crushed aggregate blended with GraniteCrete admixture. Provide sufficient stakes to secure in place.

3.03 INSTALLATION

- A. Granitecrete mixing method:
 - 1. For installations of less than 500 square feet mixing may be done on-site.
 - 2. For installations of 500 to 3,000 square feet, material must be delivered pre-mixed to the site from a GraniteCrete Inc. approved pre-mix facility.
 - 3. For installations over 3,000 square feet, it is required to use a volumetric truck.
- B. Installation Depth
 - 1. For pedestrian applications, GraniteCrete is installed as a 3-inch thick layer (lift) over a 4-inch subgrade of base rock. Compaction rates for all applications are 88%–92%.
 - 2. Please note: GraniteCrete compacts approximately 25%, or ¼" per 1" of lift.
- C. "Dry" Method installation:
 - 1. The dry method is for installations up to 6,000 square feet.
 - 2. Class II Base Rock: Moisten and compact base rock on the entire installation area to an even depth of 4-inch. A vibratory plate can be used to compact the base rock; it should not be used to compact the GraniteCrete.
 - 3. GraniteCrete: Wheelbarrow the prepared GraniteCrete/DG mixture to the installation site and place a layer of the mixture to one-half of the desired final lift. Be sure to spread the mixture out before proceeding to step 3; this will ensure the mixture is moistened and mixed thoroughly.
 - 4. Moisten the material with a hose end trigger sprayer attachment, avoiding puddling - oversaturation is detrimental and will negatively affect the integrity of the finished product. Rake area lightly to evenly distribute water throughout the mix or "lift". Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners.
 - 5. Add dry-mixed material as needed to get to your desired grade. Repeat step 3.

6. Proper moisture content can be checked by clenching your fist around the GraniteCrete, when the mixture just stays together and the color just starts to transfer to your hand, GraniteCrete is ready to compact.
 7. Compaction: After proper moisture is achieved for compaction, hand tamp (with a 10" hand tamp) around benches, sign posts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.
 8. Make several passes with a 36" lawn roller (filled with water). Compact until there are no visible marks from compaction. Hand tamp out any imperfections with a 6" wooden masonry float. Pay particular attention to ensure accuracy in grading.
 9. Make sure to keep your 10" hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match the existing finish.
 10. When laying GraniteCrete in batches, be sure to use the cold joint method below to ensure a blemish-free installation.
 11. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a medium-bristled push broom. Then make several passes with the lawn roller until the desired surface texture is achieved. Make sure to keep the drum clean at all times. Remove spoils off the surface.
 12. Do not allow GraniteCrete to dry during installation. Mist lightly with a hose end spray head as necessary or cover with a plastic tarp.
 13. The final step for a GraniteCrete installation is a dampening with water of all newly-installed and compacted GraniteCrete materials. Using a shower head/spray hose attachment, moisten the entire newly-installed GraniteCrete area - avoid puddling. For best results, moisten all newly-installed GraniteCrete paving a second time the following 1 to 5 days, as practical. Slow curing of GraniteCrete is important to avoid cracking.
 14. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.
- D. "Wet" Method installation:
1. The wet method is for installations over 6,000 square feet and may require the use of a volumetric truck.
 2. The use of an approved volumetric truck is required - see GraniteCrete website for approved volumetric truck companies.
 3. Class II Base Rock: Moisten and compact base rock of the entire installation area to an even depth of 4-inch. A vibratory plate can be used to compact the base rock; it should not be used to compact the GraniteCrete
 4. Compaction: Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners. Rake or grade area with the flat side of a landscape or asphalt rake (do not use tang side,) until the GraniteCrete is one inch above finish grade.
 5. Once initial compaction has been completed, hand tamp (with a 10" hand tamp) around benches, sign posts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.
 6. Make several passes with a 36" lawn roller in static position. Compact until there are no visible marks from compaction. Hand tamp out any imperfections with a 6" wooden masonry float. Pay particular attention to ensure accuracy in grading.
 7. Make sure to keep your 10" hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match the existing finish.

8. When laying GraniteCrete in batches, be sure to use the cold joint method below to ensure a blemish-free installation.
 9. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a medium-bristled push broom. Then make several passes with a lawn roller until the desired surface texture is achieved. Remove spoils off the surface.
 10. Do not allow granitecrete to dry during installation. Mist lightly with a hose end spray head or garden sprayer as necessary or cover with a plastic tarp.
 11. The final step for a GraniteCrete installation is a dampening with water of all newly-installed and compacted GraniteCrete materials. Using a shower head/spray hose attachment, moisten the entire newly-installed GraniteCrete area - avoid puddling. For best results, moisten all newly-installed GraniteCrete paving a second time the following 1 to 5 days, as practical. Slow curing of GraniteCrete is important to avoid cracking.
 12. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.
- E. The following information is applicable to BOTH installation methods.
1. You may walk on GraniteCrete immediately after installation. However, like concrete, GraniteCrete gets stronger with time. Ideally, traffic should stay off the newly-installed GraniteCrete areas for a minimum of 48 hours.
 2. Newly installed GraniteCrete paving surfaces are fully cured in 28 days. At that time, the entire surface should be blown or swept off to eliminate loose surface materials. Minor cracking may take place. However, over time, the aggregate fines will fill in the minor cracks and they should disappear. Occasional blowing off of the surface will help to minimize loose surface materials.
- F. Cold Joint Methods
1. Cold joints can be used at the end of the workday.
 - a. Method One:
 - 1) 1. "Between pours," stop at an area that makes the joint location look intentional. Take a chalk snap line just back from loose GraniteCrete into the compacted area and create a chalk line. Use either a masonry blade - or a square-nose shovel - and cut a straight line across the installation.
 - 2) 2. Continue with installation: Dampen the prior installation area. Place newly mixed GraniteCrete into the area, being careful not to overlap existing compacted material. Place a three foot length of 2"x4" carefully along the edge of the new pour and compact by hitting/tapping the board with a single jack. Then, take a medium-bristled push broom and very lightly "feather" the two pours together.
 - b. Method Two:
 - 1) 1) Place a 2"x4" or 2"x6" piece of wood across the installation, loosely stake it, and finish compacting the material. Leave the board in place overnight.
 - 2) 2) The next day, carefully lift the wood up and away from the installed GraniteCrete. Continue the installation process as per step 2 under Method One, making sure to dampen the prior installation area.
 - c. Method Three: (Suggested for large open edges at the end of the work day)
 - 1) 1) Install steel edging at a location that looks "intentional" and aesthetically "makes sense." Permanently install using the stakes provided. Completely finish the first day's work.

- 2) The next day, simply continue with the installation. Make sure to dampen the prior installation area first. Leave the edging in place. Again, being careful not to leave any new material on the previously installed GraniteCrete.

3.04 IMPORTANT NOTES:

- A. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it's ready for installation. Excessive moisture level may result in "sticky" materials complicating the quality of the finish surface or proper compaction – if you squeeze the mixture and water oozes out, it is too damp. If the material is too wet, it may be placed on the bottom of the installation, with material that has a better moisture content on top.
- B. Saw cut expansion joints every 5' in narrower paths, every 12' in wider paths, and at every engineered stress area. Wait 48 hours before cutting.
- C. Completed, finished surface shall be of consistent quality and free of deleterious materials such as organic materials, nails, stones, and loose material. Surface shall not have depressions or humps greater than [1/4] inch in ten feet. Cold joints, if any, should be inconspicuous.
- D. Pay particular attention to ensure accuracy in grading. If grading issues occur during installation, they need to be addressed right away. You cannot wait until the end to fix grading issues.

3.05 CURING PERIOD / PROTECTION

- A. Do not allow traffic on crushed aggregate blended with GraniteCrete admixture surfacing for a minimum of 72 hours after placement or until compacted GraniteCrete crushed aggregate blended with GraniteCrete admixture surfacing has fully cured. Cover for extended curing period. If the temperature is below 50 degrees Fahrenheit, extend this to 5 days. If rain is in the forecast during the curing period, cover the product with plastic.
- B. Protect crushed aggregate blended with GraniteCrete admixture surfacing from damage until project completion. Repair damaged areas to match specified requirements.

3.06 MAINTENANCE & REPAIRS

- A. Follow manufacturer's recommendations.
- B. Maintenance: Depending on the end user's desired finish surface, maintenance may require occasional blowing off or brooming of paved surface - DO NOT use a pressure washer to clean GraniteCrete. Depending on quality of compaction at time of installation, a thin veneer of loose aggregate material is typical after the full 28 days cure period. If cracking appears in a GraniteCrete surface, broom loose aggregate "fines" into cracks and compact with a rubber mallet.
- C. Repair: When repairing GraniteCrete it is important to use the original aggregate/decomposed granite and the original GraniteCrete Admixture color to match previously installed materials. If the paved surface has large areas of raveled material (loose aggregate/decomposed granite) the initial installation may not have been properly compacted, or blended materials did not have optimum moisture content

during installation. GraniteCrete must not be allowed to dry prior to final compaction. The following are suggestions for repair of raveled materials:

1. For large loose/raveled areas, a minimum of 2 inches of GraniteCrete can be saw-cut at agreed length, removed, and re-installed. Repeat the installation steps.
2. In areas that collapse/fail due to equipment weight, re-form and re-install with original materials as per specifications.
3. Minor Crack Repair - With Sand Mixture:
Use a fine mesh sand - typically sold as "playground sand" or "play sand." Mix the sand and GraniteCrete together as though the sand is decomposed granite (use the same ratio as was used for the GraniteCrete installation). This will create a dry mix, similar to polymeric sand. Apply the sand mixture down into the crack using the appropriate tool (trowel, shovel, broom, et cetera). Fill the crack $\frac{3}{4}$ of the way to the top grade. Usually at the point post-installation that cracks begin to be seen, you will also see loose material on top. Sweep that loose material into the remaining $\frac{1}{4}$ top of the void. Try to not leave any sand mixture/patch material on the top of the installation - you want it as clean as possible; you can use a blower to help remove the sand mixture. Once the surface is clear of patch material, carefully wet the material. The cracks should virtually disappear.

END OF SECTION

SECTION 32 16 00

SITE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. The Section describes the requirements for providing portland cement concrete paving, including accessibility ramps, sidewalks, accessible routes of travel, vehicular travel, drain structures, sewer structures, thrust blocks and for other non-structural or non-vehicular applications.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 310000, Earthwork.

1.02 REFERENCES AND STANDARDS

- A. California Building Code, latest edition.
- B. ACI Standards, ACI 211.1, ACI 318-14, ACI 302, IR-04, ACI 301-16, ACI 305R-10, ACI 306R-16, ACI 308-16.
- C. ASTM C-94, Specification for Ready-Mixed Concrete.
- D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).
- E. ASTM – American Society for Testing and Materials.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface

treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

- D. With concrete submittal, provide documented history of mix design performance.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products.
- B. Use materials and products of one manufacturer whenever possible.
- C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.
- B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.
- C. Transport, store and handle in strict accord with the manufacturer's written recommendations.
- D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.
- E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.
- F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.06 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.07 TESTING

- A. General: Refer to Section 01 40 00 – Quality Requirements.
- B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing

may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.

1.08 ADEQUACY AND INSPECTION

- A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.
- B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.09 PROTECTION

- A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.10 FIELD MEASUREMENTS

- A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement: Portland cement, ASTM C150, Type II, per ACI 318-14 Section 26.4.
- B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.
- C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318-14 Section 26.4.1.3.1.
- D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.
- E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318-14 Section 26.4.1.4.19(a). Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.
- F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-14, section 26.4.1.4.
- G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.

- H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.
- I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.
- J. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3'-0" O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3" concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.
- K. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; "Armor-Tile", "Access Tile Tactile Systems", or approved equal. Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35"). Install tiles as recommended by manufacturer. Color, federal yellow (FS 33538).
- L. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C 309 and C1315.
- M. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.
- N. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.
- O. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed, non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.
- P. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.
- Q. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.
- R. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.
 - 1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
 - 2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.
 - 3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
 - 4. Color: Custom color as selected by Architect.
- S. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap, or

an approved equal.

T. Adhesive Anchoring (Epoxy): Hilty HIT-HY 200 Safe Set, or approved equal.

2.02 CONCRETE DESIGN AND CLASS

- A. Class "B": Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.
- B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".
- C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.
- D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.03 MIXING OF CONCRETE

- A. Conform to requirements of CBC, Chapter 19A.
- B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.
- C. Concrete shall be Ready-mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3.1, when approved by Structural Engineer and DSA.
 - 1. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
 - 2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
 - 3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.
 - 4. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.
 - 5. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
 - 6. Water may be added to the mix only if neither the maximum permissible water-cement ratio

nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.04 MATERIALS TESTING

- A. Materials testing of concrete and continuous batch plant inspection may be waived in accordance CBC Sections 1704A.4.4 when approved by Structural Engineer and DSA.
- B. Testing of concrete shall be performed per article 3.12 of this specification.

2.05 EQUIPMENT

- A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 - EXECUTION

3.01 APPROVAL OF FORMS AND REINFORCEMENTS

- A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given to DSA, Architect and Structural Engineer 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.
- B. All reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.
- C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.
- D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
 - 1. The bars shall be placed so that there will be a minimum of 1 ½" clearance and a maximum of 3" clearance. The reinforcing steel shall be placed mid-depth of concrete slab.
- E. At all right angles or intersections of concrete walks, additional 2'x2' #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2" from concrete forms and supports at mid-depth of slab.

3.02 PROTECTION

- A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at

no additional cost to the Owner.

- C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.03 CLEANING

- A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.
- B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.04 FORMING

- A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.
- B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.
- C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.
- D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.
- E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.
- F. Slope tie-wires downward to outside of wall.
- G. Brace, anchor and support all cast-in items to prevent displacement or distortion.
- H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.
- I. Concrete paving, Curbs, Curb and Gutters, Ramps:
 - 1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20' for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of

concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.

2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60' on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
3. Isolation Joints: 3/8" felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
4. Exterior Concrete Paving: Install expansion joints at 20' on center maximum, both directions, unless shown otherwise on plans.
5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.
 - a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
 - b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.05 FORM COATING

- A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.
- B. Before re-using form material, inspect, clean thoroughly and recoat.
- C. Seal all cut edges.

3.06 INSTALLATION

- A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.
- B. Placing Tolerances:
 1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.
 2. Clear distance between parallel bars in a layer shall be no less than 1", the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.
- C. Splices:

1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
 - a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice. 93 bar diameters for No. 7 bars and larger.
 - b. All splices shall be staggered at 5 feet minimum.

3.07 INSPECTION

- A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.
- B. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.08 PLACING OF CONCRETE

- A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.
- B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.
- C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.
- D. Remove form spreaders as placing of concrete progresses.
- E. Place footings as monolithic and in one continuous pour.
- F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.
- G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.
- H. Concrete Flatwork:
 1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10' for flatness. Flatwork which is not flat and are outside of

the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.

2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
 3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.
- I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.
- J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.
- K. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.09 CONCRETE FINISHES

- A. Concrete Slab Finishing: Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use "jitterbugs" or other special tools designed for the purpose of forcing the course aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:
1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
 2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
 3. Under no circumstances can water be added to the top surface of freshly placed concrete.
- B. Curb Finishing: Steel trowel.
- C. Joints and Edges: Mark-off exposed joints, where indicated, with ¼" radius x 1" deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.

1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.
- D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.
- E. Stair Treads and Risers: Tool exterior stair tread nosing per ADA requirements and as detailed. Paint or stain tooled area at every stair tread nosing or as detailed. Stair tread nosing shall contain no pockets, voids or spalls. Patching is not allowed. Damaged nosing shall be replaced.

3.10 CURING

- A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.
- B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.
 1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.
- C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

- A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.
- B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any

- surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.
- C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.
 - D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.
 - E. Defective concrete is:
 - 1. Concrete that does not match the approved mix design for the given installation type.
 - 2. Concrete not meeting specified 28-day strength.
 - 3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
 - 4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
 - 5. Concrete containing embedded wood or debris.
 - 6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
 - 7. Concrete not containing required embedded items.
 - 8. Excessive Shrinkage, Traverse cracking, Cracking, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
 - 9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
 - 10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
 - 11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
 - 12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
 - 13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.
 - F. Patching: Install specified Patching Mortar per manufacturer's recommendations. REPAIRS TO DEFECTIVE CONCRETE WHICH AFFECT THE STRENGTH OF ANY STRUCTURAL CONCRETE MEMBER OR COMPONENT ARE SUBJECT TO APPROVAL BY THE ARCHITECT AND DSA.

3.12 CONCRETE TESTING

- A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.
- B. Four identical cylinder 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. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.
- C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.
 - D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
 - E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.
 - F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

- A. Remove without damage to concrete surfaces.
- B. Sequence and timing of form removal shall insure complete safety of concrete structure.
- C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
 - 1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
 - 2. Slab edge screeds or forms: 7 days.
 - 3. Concrete columns and beam soffits: 28 days.
- D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean excess material from surface of all concrete walks and utility structures.
- D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION

SECTION 32 18 16.13
PROTECTIVE PLAYGROUND SURFACES

PART 1 – GENERAL

1.01 Summary

- A. Provide all labor, materials, and tools necessary for the complete installation of a poured in place safety surfacing system as outlined in these specifications. The system should consist of, but not necessarily be limited to, the following:
1. Section includes: Resilient playground surfacing poured in place system.
 2. Related work: Playground equipment and resilient playground surfacing sub base.
 3. Quality Assurance: Manufacturer should have manufactured and installed playground poured in place safety surfaces for a minimum of 5 years and meet current ASTM F-1292 Test Criteria. The installation of the poured in place product should be completed by FLEXGROUND. Manufacturer's detailed installation procedures should be submitted to the Architect and made part of the Bid Specifications.

1.02 Submittals

- A. Prospective manufacturers and/or installers of the poured in place safety surfacing system should be required to comply with the following:
1. The manufacturer must be experienced in the manufacturing of a poured in place safety surfacing system and provide references of five (5) specific installations in the last three (3) years.
 2. The installer must provide competent workmen skilled in this specific type of poured in place safety surfacing system installation. The designated supervisory personnel on the project must be competent in the installation of this material, including mixing of the materials, and spreading and compacting the materials correctly.
 3. Installation should be in accordance with ASTM F1292-09 for Impact Attenuation of surface system under and around playground equipment. The poured in place system to be installed in compliance with the Critical Fall Height as determined by the Playground Equipment.
 4. IPEMA Certification specific to poured in place safety surfacing.
 5. IPEMA certification specific to ½" layer of TPV over cushion layer with a grout sealer, rendering it non-porous.
 6. Manufacturer should provide written instructions for recommended maintenance practices.
 7. Manufacturer should submit color samples for customer verification.
 8. Performance Requirements: Provide products that have been manufactured, fabricated and installed to meet or exceed the criteria and methodology identified in PARTS 2, 3 and 4 below.
 9. Quality Assurance:
 - a. Test reports: upon request, provide the test reports from recognized, qualified, independent third-party testing laboratories. Self-testing of products is not acceptable.
 - b. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.
 10. Surfacing shall comply with 11B-1008.2.6.2.

1.03 Definitions

- A. EPDM Granules: EPDM rubber (ethylene propylene diene monomer(M-class) rubber), a type of synthetic rubber, is an elastomer characterized by a wide range of applications. The M refers to its classification with the ASTM standard D-1418; the M class includes rubbers having a saturated chain of the polymethylene type.
- B. Critical Fall Height: A critical fall height (CFH) is the maximum height of fall from play equipment to the ground. It is important to note that safety surfaces do not prevent injury but aim to lessen the severity of any injury that may occur on falls from height.
- C. Fall Height: Fall height is a measurement defined as the vertical distance between a designated play surface and the protective surfacing beneath it.
- D. TPV: Thermoplastic Vulcanized Elastomer. Developed using resin and synthetic rubber with higher UV stabilization.
- E. SBR: Styrene-butadiene or styrene-butadiene rubber (SBR) describe families of synthetic rubbers derived from styrene and butadiene.

1.04 Warranty and Maintenance

- A. The bidder and/or poured in place safety surfacing manufacturer must provide the following:
 - 1. The poured in place safety surfacing manufacturer should provide a warranty to the owner that covers defects in materials and workmanship of the rubber for a period of FIVE (5) years from the date of Substantial Completion.
 - 2. The manufacturer's warranty should include general wear and tear. The warranty should specifically exclude vandalism, high heel punctures, acts of war or acts of nature beyond the control of the owner or the manufacturer.
 - 3. All poured in place warranties should be limited to repair or replacement of the affected areas and should include all necessary materials, labor, transportation costs, etc. to complete said repairs.
 - 4. The manufacturer should instruct the owner's personnel on proper maintenance and repair of the ENDURAFLEX & XTREME safety surface.
 - 5. All warranties, expressed or implied, are contingent upon the following: 1. installation being performed by FLEXGROUND, 2: Owner, at owner's expense, having a FlexCoat (and ColorSeal in designated areas) performed at 2 year intervals from date of substantial completion, and 3. Full payment by the owner of all pertinent invoices and adherence to any required maintenance procedures.

PART 2 – PRODUCTS

2.01 Manufacturers

- A. The ENDURAFLEX & XTREME poured in place safety surfacing system should be in accordance with the following:

- B. A dual durometer poured in place system with a wearing layer upper membrane, grouted and sealed in designated high-wear areas and an underlying impact attenuation cushion layer. The finished surface should be capable of being installed at varying thickness to comply with the Critical Fall Height requirements of the playground equipment.
- C. Total System Depth for Fall Heights:
 - a. Fall height 4'-0" above grade, 2 inch thick system.
 - b. Fall height 5'-0" above grade, 2-1/2 inch thick system.
 - c. Fall height 6'-0" above grade, 3 inch thick system.
 - d. Fall height 8'-0" above grade, 3-1/2 inch thick system.
 - e. Fall height 10'-0" + above grade, 4-1/2 inch thick system.
 - f. Confirm all system thicknesses with manufacturer's requirements prior to installation.
- D. FLEXGROUND primer is a 100% solids urethane primer/sealer. It is designed with low viscosity and penetrating abilities making this an ideal priming urethane.
- E. The cushion layer, if required, should be a mixture of black recycled SBR rubber buffings mixed with a 100% solids moisture cured MDI Polyurethane binder (100 pounds of SBR rubber buffings to 12 pounds of binder) installed at the appropriate thickness. The cushion layer should be porous.
- F. The ENDURAFLEX & XTREME SURFACING wearing surface should be manufactured from TPV virgin colored rubber granules mixed with an aromatic or aliphatic urethane binder (110 pounds of TPV to 22 pounds of binder).
- G. FLEXGROUT should be a thixotropic thermoplastic paste applied at 1 gallon per 35 square feet over wear course layer in designated high-wear areas. Substitutions must prove equal and provide ASTM testing per item #F below.
- H. FLEXGROUT thermoplastic composite grout was tested by QAI Laboratories for the following:
 - a. ATSM D 2047-11 Coefficient of Friction: Polish Flooring Surface. (Test Report #QI1411123-4) FlexGrout has been tested and certified at a friction of .588 dry standard, and .817 wet standard.
 - b. ATSM D4 12-06ae2 ThermoPlastic Elastomers – Tension. (Test Report #QI1305148-2) FlexGrout has been tested and certified at Peak Tensile Strength of 163psi; chlorine soaked at 133psi; and a Tensile Elongation at Break of 132.2%; chlorine soaked at 112.2%.
 - c. ATSM D624-00(2012) Tear Strength. (Test report #QI1305148-2) FlexGrout has been tested and certified with a median Maximum Tear Strength of 75.74lbs; chlorine soaked at 70.03lbs.
- I. A water-based composite color seal should be applied at a 200 sq. ft. per gallon and spread evenly to cover designated FlexGrout areas.
- J. The system color should be selected from Manufacturer's TPV and Xtreme Color Charts by owner prior to bid. EnduraFlex TPV color options should include 50% standard color and 50% premium color with ALIPHATIC urethane.

PART 3 – SITE PREPARATION AND BASE**3.01 GENERAL**

- A. Install all systems in full accordance with manufacturer's recommendations.
- B. Slope across finished product shall not be greater than 2% in any direction. Contractor shall carefully checked grades during installation of perimeter curb and play equipment access points to assure that all slopes are less than 2%.

3.02 SITE PREPARATION AND BASE

The ENDURAFLEX site preparation and base should be in accordance with the following:

- A. The sub-base will have a slope of 2%.
- B. The base aggregate should consist of a minimum of four inches (4") free-draining stone compacted to 95%. Finish slope of porous aggregate should be 2% from the centerline of the area to the perimeter, and the grade should not vary more than a quarter inch (¼") in ten feet (10').
- C. The sub base should be installed in two-inch (2") lifts to appropriate thickness.
- D. The sub-base should be compacted using vibrating tamper, to approximately 95% Proctor density.
- E. The sub-grade should no longer have any vegetation.
- F. Subgrade prior to aggregate installation: Sublevel grade is to be compacted prior to the ABC aggregate installation. Particular attention should be paid to areas of disturbed earth such as where footers for playground equipment enter the ground. Concrete should be poured to the top of sublevel surface.
- G. The poured in place safety surfacing manufacturer and architect will accept the aggregate base in writing prior to the installation of the poured in place system.
- H. Any alterations must be agreed between all parties.
- I. Hard Base Construction: For concrete surfaces, shot blast, acid etch or power scarify as required to obtain optimal bond of the Cushion Layer to the concrete. Remove sufficient material to provide a sound surface, free of glaze, efflorescence, or form release agents. Remove grease, oil, and other penetrating contaminants.
- J. For concrete or asphalt surface that is not enclosed (i.e. a curb to curb pour), the concrete shall have keyway cuts 1.5" wide by 1.5" deep so that the system can be bull nosed down into the notch area.

3.03 Installation

- A. The poured in place safety surfacing installer should strictly adhere to the installation procedures outlined under these sections. Any variance from these requirements should be accepted in writing

by the manufacturer's onsite representative and submitted to the architect/owner, verifying that the changes do not in any way affect the warranty.

3.04 Perimeter

- A. A urethane primer should be applied to concrete, asphalt or wood surfaces at a rate of 200-250 square feet per gallon. The entire area does not need to be primed at once, instead, prime about 700 square feet at a time. This procedure should be continued until all areas are complete.
- B. The urethane primer should be applied to any playground equipment that will be surrounded by the poured in place safety surfacing system.

3.05 Cushion Layer

- A. Provide a single pour installation for each area. No seams allowed in material.
- B. The components of the poured in place safety surfacing should be mixed on site in a mixer to ensure a comprehensive mix according to manufacturer's instructions.
- C. The cushion layer comprised of SBR buffings shall be mixed with the MDI moisture cure polyurethane binder at a rate of 12% of the total weight of the material thoroughly so that the binder is evenly dispersed into the rubber base.
- D. The cushion layer comprised of non-tire derived SBR & EPDM Chunk Rubber shall be mixed with the appropriate amount of urethane so that the binder is evenly dispersed into the rubber base.
- E. The cushion layer mix should then be spread and troweled to the desired depth and allow to cure for 24 hours.

3.06 Wear Course Layer

- A. Provide a single pour installation for each area. No seams allowed in finished product.
- B. The wear course layer should be mixed with 1-4mm TPV granules and urethane binder at a rate of 20% of the total weight of the materials so the granules are covered thoroughly and evenly.
- C. The wear course layer mix should be spread and troweled to a depth of a half inch ($\frac{1}{2}$ ") immediately after the application of primer.
- D. Where seams are required due to color change, a step configuration with a 4" overlap will be constructed to maintain wear surface integrity.
- E. The finished texture should be slip resistant, smooth and even.
- F. The poured in place surface should be allowed to cure for 24-72 hours or until dry to the touch.

3.07 Grout Sealer at High Wear Areas.

- A. Provide at base of main access point to structure, at bottom of slides, beneath swings, other high traffic, high wear areas.
- B. The wear course layer should be sealed with a thermoplastic composite grout. FLEXGROUT should be spread with a trowel at a rate of 1 gallon per 30 square feet. Pressure should be applied to the trowel with enough force to push the grout into the wear course layer, rendering it impermeable. The finished texture should be slip resistant and even.
- C. The poured in place surface should be allowed to cure for 24-72 hours or until dry to the touch.
- D. Color Seal - The color seal should consist of a water based composite liquid. Color seal should be rolled (or can be sprayed) to completely cover entire surface. The color seal should be allowed to cure for 24-72 hours or until dry to touch.

3.08 Clean up

- A. Trailer/ Large truck access will be necessary for the installation. In the case that access for trailer/truck is not available the owner or general contractor will be responsible for transporting material to the job site.
- B. Crew is responsible for protecting the surface only while on site. General Contractor or owner shall be responsible for the security of the surfacing overnight during installation, as well as during the surfacing's curing period upon completion of the install.
- C. Crew will leave site clean and shall remove all trash and debris.
- D. Owner/General contractor shall provide a dumpster for all waste and trash.

END OF SECTION

SECTION 32 18 16.16
SYNTHETIC TURF

PART 1 – GENERAL

1.01 Work Included

Provide all labor, materials, equipment, and tools necessary for the complete installation of an attenuated synthetic grass infill system as outlined in these specifications. The system should consist of but not necessarily be limited to the following:

- A. A vertical draining field base consisting of a four-inch layer of compacted $\frac{3}{4}$ " Class 2 aggregate compacted to 95%.
- B. A complete synthetic grass system, consisting of:
 1. Synthetic turf
 2. Cushion layer
 3. An infill system, consisting of a specially formulated non-expansive, coated, clean, dust free and specially sized silicon dioxide bead (Envirofill brand preferred).
- C. This shall be a 100% nail free system with installation by adhesive only. An edging system consisting of minimum 2" thick by 6" wide rubber or concrete glue down strip around the perimeter and encompassing any protrusions in the turf area.
- D. Quality Assurance: Manufacturer should have manufactured and installed synthetic grass surfaces for a minimum of 5 years. The installation of the synthetic grass product should be completed by FLEXGROUND. Manufacturer's detailed installation procedures should be submitted to the Architect and made part of the Bid Specifications.

1.02 Submittals

Prospective manufacturers and/or installers of the turf should be required to comply with the following:

- A. The turf manufacturer must be experienced in the manufacture of a no nail synthetic grass system and provide references of five (5) specific installations in the last three (3) years.
- B. The turf installer must provide competent workmen skilled in no nail synthetic grass installation. The designated supervisory personnel on the project must be competent in the installation of this material, including gluing seams and proper installation of the infill mixture.
- C. Installation should be in accordance with ASTM F1292 for Impact Attenuation of surface system under and around playground equipment. The poured in place system to be installed in compliance with the Critical Fall Height as determined by the Playground Equipment (if any).
- D. IPEMA Certification specific to poured in place rubber and synthetic grass safety systems.
- E. Manufacturers should provide written instructions for recommended maintenance practices.

- F. Manufacturer should submit samples for customer verification. Samples shall include two 6" x 6" samples of 1" cushion layer topped with synthetic turf (a 1.5" system) and attached with turf adhesive.

1.03 Definitions

- A. Critical Fall Height: A critical fall height (CFH) is the maximum height of fall from play equipment to the ground. It is important to note that safety surfaces do not prevent injury but aim to lessen the severity of any injury that may occur on falls from height.
- B. Fall Height: Fall height is a measurement defined as the "vertical distance between a designated play surface and the protective surfacing beneath it.
- C. SBR: Styrene-butadiene or styrene-butadiene rubber (SBR) describe families of synthetic rubbers derived from styrene and butadiene

1.04 ASTM Testing Standards

- A. ASTM D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- B. ASTM D2859 Standard Test Method for Flammability of Finished Textile Floor Covering Materials
- C. ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester
- D. ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment
- E. ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment
- F. ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method – This standard replaces ASTM D2047
- G. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers- Tension

1.05 WARRANTY AND MAINTENANCE

The bidder and/or the turf manufacturer must provide the following:

- A. The turf manufacturer should provide a warranty to the owner that covers defects in materials and workmanship of the turf for a period of **FIVE (5) years** from the date of Substantial Completion, and **TWO (2)** years on seams.
- B. The manufacturer's warranty should specifically exclude vandalism, acts of War and acts of Nature

beyond the control of the owner of the manufacturer.

- C. All turf warranties should be limited to repair or replacement of the affected areas and should include all necessary materials, labor, transportation costs, etc. to complete said repairs.
- D. All warranties are contingent upon full payment by the owner of all pertinent invoices and owner, at owner's expense, completing a full power-brooming and "top-off" of lost infill at two-year intervals from date of substantial completion.
- E. The bidder should provide a maintenance program to the owner. The warranty should be subject to compliance with said maintenance program in addition to items named above.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

The synthetic turf material and resilient cushion should be in accordance with the following:

- A. Acceptable Manufacturer: FlexGrass Premier Turf no nail system by Flexground.
- B. Or approved equal.

2.02 SYSTEM REQUIREMENTS

- A. A poured in place system with a synthetic grass wearing layer upper membrane and an underlying impact attenuation cushion layer. The finished surface should be porous and capable of being installed at varying thickness to comply with Critical Fall Height requirements of playground equipment.
- B. The cushion layer should be a mixture of black recycled rubber mixed with a 100% solids moisture cured aromatic Polyurethane binder (100 pounds of rubberized cushion layer to 12 pounds of binder) installed at the appropriate thickness.
- C. Synthetic Turf shall be:
 - 1. A 1-1/2" monofilament polyethylene with brown thatch yarn, formulated for superior wear resistance and a secondary proprietary polyethylene thatch. Product must have built-in antimicrobial protection to inhibit the growth of bacteria, mold, mildew, and reduce odor.
 - 2. The system should be tufted with a minimum of 60 ounce of yarn per square yard. The system should also include a primary woven polypropylene backing and a polyurethane secondary backing. Finish coating shall be at 22 ounces per square yard.
 - 3. The machine gauge shall be 1/2". Tufted pile height is 1-1/2".
 - 4. Total fabric weight shall be at least 88 ounces per square yard.
 - 5. The finished product should also include perforations to ensure drainage greater than 30 inches per hour. Non-perforated systems should not be acceptable alternates for purposes of this specification.

- D. The turf should be delivered in 15' wide rolls.
- E. All lines, numbers and markings indicated on plans should be permanently inlaid. Painted lines should not be an acceptable alternative for purposes of this specification.
- F. The fiber should be green in color to simulate natural grass as closely as possible and treated with UV inhibitor, guaranteed a minimum of eight years.
- G. The infill system should be an a non-expansive engineered coated, clean, dust free and specially sized silicon dioxide beads.
- H. Latex backed turf shall not be acceptable. All adhesives must also be latex free.

PART 3 – EXECUTION

3.01 SITE PREPARATION AND BASE

- A. The sub-base will have a slope of 2%.
- B. The base aggregate should consist of a minimum of four inches (4") of ¾" Class 2 aggregate compacted to 95%. Finish slope of porous aggregate should be 2% from the centerline of the area to the perimeter, and the grade should not vary more than a quarter inch (¼") in ten feet (10').
- C. The sub base should be installed in two inch (2") lifts to appropriate thickness.
- D. The sub-base should be compacted using vibrating tamper, to approximately 95% Proctor density.
- E. The sub-base should no longer have any vegetation.
- F. Subgrade prior to aggregate installation: Sublevel grade is to be compacted prior to the ABC aggregate installation. Particular attention should be paid to areas of disturbed earth such as where footers for playground equipment enter the ground. Concrete used to fill said areas/footers should be poured to the top of sublevel surface.
- G. The sub-base installer and architect will accept the aggregate base in writing prior to the installation of the poured in place system.
- H. Any alterations must be agreed between all parties.
- I. Hard Base Construction: For concrete surfaces, shot blast, acid etch or power scarify as required to obtain optimal bond of the Cushion Layer to the concrete. Remove sufficient material to provide a sound surface, free of glaze, efflorescence, or form release agents. Remove grease, oil, and other penetrating contaminants.
- J. For concrete or asphalt surface that is not enclosed (i.e. a curb to curb pour), the concrete shall have keyway cuts 1.5" wide by 1.5" deep so that the system can be bull nosed down into the notch area.

3.02 INSTALLATION

The FLEXGRASS safety surfacing installer should strictly adhere to the installation procedures outlined under these sections. Any variance from these requirements should be accepted in writing by the manufacturer's onsite representative and submitted to the architect/owner, verifying that the changes do not in any way affect the warranty.

A. Primer

1. A urethane primer should be applied to concrete, asphalt or wood surfaces at a rate of 200-250 square feet per gallon. The entire area does not need to be primed at once, instead, prime about 700 square feet at a time in immediate advance of rubber installation. This procedure should be continued until all areas are complete.
2. The urethane primer should be applied to any playground equipment that will be surrounded by the poured in place safety surfacing system.

B. Cushion Layer

1. The components of the poured in place safety surfacing should be mixed on site in a mixer to ensure a comprehensive mix according to manufacturer's instructions.
2. The cushion layer comprised of SBR buffings shall be mixed with the aromatic moisture cured polyurethane binder at a rate of 12% of the total weight of the material thoroughly so that the binder is evenly dispersed into the rubber base. Or;
3. The cushion layer comprised of non-tire derived SBR & EPDM Chunk Rubber shall be mixed with the appropriate amount of urethane so that the binder is evenly dispersed into the rubber base.
4. The cushion layer mix should then be spread and troweled to the desired depth and allow to cure for 24 hours.

C. Synthetic Turf Layer

5. The synthetic grass should be cut and laid out across the area, and utilizing standard state-of-the-art gluing procedures, each roll should be seamed to the next.
6. The edge of the synthetic turf should be stapled or nailed to header/anchor board.
7. A strip of seam tape should be used to seam the rolls of material. The specified glue should be a one part urethane adhesive (SeamTight) as manufactured by FlexGround, LLC. Tempe, AZ 85281.

D. Infill

1. The infill material shall be spread evenly, at a rate of 2 lbs per square foot with a large fertilizer type spreader. The infill will be spread in strict accordance with the turf installer's specifications.
2. Between each application of infill, the field area should be brushed with a motorized rotary nylon broom.
3. Caution: Too much fiber exposed (not enough infill) will cause the fibers to mat or crush with heavy foot traffic. This will lead to premature wearing of the fiber and will void any manufacturer's warranty. No Crumb Rubber shall be used as infill.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Fence framework, fabric, and accessories.
2. Excavation for post bases; concrete foundation for posts.
3. Manual gates and related hardware.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 71 00: Door Hardware.
3. Section 32 16 00: Site Concrete.

1.02 REFERENCES

- A. ANSI/ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- B. ANSI/ASTM F567 – Installation of Chain link Fence.
- C. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM C94 – Ready-mixed Concrete.
- E. Chain link Fence Manufacturers’ Institute (CLFMI) – Product Manual.

1.03 SYSTEM DESCRIPTION

- A. Fence Height: 6’-0” unless otherwise noted.
- B. Line Post Spacing: At intervals not exceeding 10 feet.

1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Submit samples of Vinyl Slats for color selection by Engineer.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Installer: Company specializing in installations of chain-link fencing with a minimum of five years of experience. If any welding is required provide welders' certificates, verifying AWS qualification within the previous 12 months.

1.05 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on shop drawings.

1.06 WARRANTY

- A. Manufacture of slats to provide a 25 year warranty against color fading and breakage of slats.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Fabric:
 - 1. Type C - Non-Slatted Fabric: Green vinyl coated tight weave: 2" mesh, 9-gauge zinc coated steel wire coated with green vinyl, top selvage knuckled tight, bottom selvage knuckled end closed. Posts to be powder coated where vinyl coated fabric occurs. Finish: ASTM F 668 Class 2b, 7mil (0.18 mm) thickness thermally fused over zinc-coated wire. Color shall be: GREEN
- B. Line Posts: ASTM F1083 SCH 40 galvanized, round, 2.875 inch diameter.
- C. Terminal and Corner Posts: ASTM F1083 SCH 40 galvanized, round, 4.000 inch diameter.
- D. Gate Posts: ASTM F1083 SCH 40 galvanized, round, 4.0 inch diameter.
- E. Gate Frame: 1-7/8 inch SCH 40 galvanized diameter, for fittings and truss rod fabrication.
- F. Top Rail, Middle Brace Rail and Bottom Rail: ASTM F1083 SCH 40 galvanized, round, 1.66 inch diameter, plain end, sleeve coupled at top.
- G. Tie Wires: 9 gauge galvanized steel wire.
- H. Concrete: ASTM C94; Portland Cement, 2,500 p.s.i. strength at 28 days, 3 inch slump; one inch maximum sized coarse aggregate.
- I. Kickplate: 12 ga. Steel hot dipped galvanized.
- J. Cane Bolt Receiver: 1-1/4" x 8" galvanized pipe.

2.02 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel galvanized.
- C. Gate Hardware: Fork latch with gravity drop mechanical keepers; three 180 degrees gate hinges per leaf and hardware for padlock. Padlock to be provided by District.
- D. ADA Accessible Gate Latch, Lockable; Paddle type lever that opens gate without full rotation.

2.03 FINISHES

- A. Components and Fabric: Galvanized to ANSI/ASTM A123; 1.2 oz./sq. ft.
- B. Hardware: Galvanized to ASTM A153, 1.2 oz./sq. ft. coating.
- C. Accessories: Same finish as framing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ANSI/ASTM F567-93 and manufacturer's instructions.
- B. Drill caissons to diameter and depth as shown in the drawings, and or details. Clean holes and remove all loose dirt to a hard undisturbed bottom.
 - 1. When placing fence posts in existing asphalt, the existing asphalt shall be cored drilled with a diamond core hole saw 3' larger than the caisson diameter. Under no circumstances shall an auger dirt bit be used to drill through the asphalt.
 - 2. When placing fence posts where the new surrounding finish surface will be asphalt, the fence posts shall be placed first before the asphalt is laid. Top of post caisson shall be at the top of aggregate base.
- C. Set intermediate, terminal and gate posts plumb in concrete caisson. Slope top of concrete for water runoff. Use concrete vibrator in each caisson during concrete placement to settle and seat concrete.
- D. Line, Terminal, and Gate Post Footing Depth Below Finish Grade: 36 inches and 12 inches diameter.
- E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, on bay from end and gate post.
- F. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- G. Install center and bottom rails all around enclosure.
- H. Stretch fabric between terminal posts.

- I. Position bottom of fabric 1 inch above finished grade.
- J. Fasten fabric to top, center and bottom rail and line posts with tie wire at maximum 12 inches on centers.
- K. Attach fabric to end, corner and gate posts with tension bars and tension bar clips at 12 inches on center.
- L. Install gate with fabric to match fence. Install three hinges per leaf, install latches, catches, retainers and locking clamp.
- M. Provide kickplate at all accessible gate accesses. Weld to gate frame with 3/16" x 1" welds at 4" o.c. Weld all 4 corners. Grind all welds and edges smooth. Treat all welds with galvanizing zinc "Hot Stick."
- N. All field welding to be performed by certified welder and all welds are to be ground down smooth and treated.
- O. All areas of welds are to be thoroughly cleaned, fluxed, and treated with galvanizing zinc "Hot Stick". Do not over heat pipe when treating.
- P. At double swing gates, install cane bolt receiver in concrete measuring 8" diameter, 12" deep.

3.02 ERECTION TOLERANCES

- A. Maximum variation from plum: 1/8 inch.
- B. Maximum offset from true position: 3/8 inch.
- C. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Ornamental picket fencing, gates and accessories.

B. RELATED SECTIONS:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 71 00: Door Hardware.
3. Section 32 13 00: Portland Cement Concrete Paving.

1.03 SUBMITTALS

- A. Shop Drawings: Layout of all fences and gates with dimensions, details and finishes of component accessories and post foundations.
- B. Product Data: Manufacturer's catalogue cuts indicating material compliance and specified options including steel tube sizes.
- C. Samples: Color selections for polyester powder coat finish.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Products from other qualified manufacturers having a minimum of 5 years experience manufacturing ornamental picket fencing will be acceptable by the architect as equal if they meet the following specifications for design, size, gauge of metal parts and fabrication (or equal).
- B. Ornamental Picket Fence and Swing Gates:
Style: Monumental Iron Works Imperial B-3 Horizontal Rails, or approved equal.
Heights: 6'0" or as otherwise indicated on the Drawings.
- C. Approved Manufacturers:
 1. Monumental Iron Works, Baltimore, MD,

Phone (888) MH-Fence, (888) 643-3623

2. Ameristar, Tulsa, OK
Phone (888) 333-3422

3. Merchant Metals
Phone (770) 741-0300
211 Perimeter Way, Suite 250
Atlanta, GA 30346

2.02 ORNAMENTAL PICKET FENCE

- A. Pickets: Square tubular members, ASTM A513, hot-rolled structural quality steel. 50,000 psi (310 Mpa) tensile strength, 60,000 psi (372 Mpa) yield strength. Minimum size pickets $\frac{3}{4}$ inches square x 16 ga. Space pickets 3-15/16" maximum (100mm) face to face. Attach each picket to each rail with $\frac{1}{4}$ " (6mm) industrial drive rivets. Size #4. Minimum gauge wall thickness solid gauge.
- B. Rails: "U" channels formed from hot-rolled structural steel having no pockets or shelves to hold water or moisture, 1-3/8" (35 mm) wide x 1-1/2" (38 mm) deep, 11-gauge (0.120" (3.05 mm) wall thickness. Punch rails to receive pickets and rivets and attach rails to rail brackets with 2 each, $\frac{1}{4}$ " (6 mm) industrial drive rivets. Size #4. Steel for rail produced under ASTM A446. Provide top rail, bottom rail, and third rail 6" below top rail.
- C. Posts: Square tubular members, ASTM A500, hot-rolled structural quality steel, 50,000 psi (310 Mpa) Tensile strength, 60,000 psi (372 Mpa) yield strength, with ASTM A525 hot-dipped galvanized G90 coating. Minimum post size 4" sq., having minimum 12-gauge wall thickness. Post size at gates as required to support specified gate leaf size.
- D. Accessories: post caps.
- E. Finish: After all steel components have been galvanized, clean and prepare the surface of all components to assure complete adhesion of finish coat. Apply 2.5 mil (0.0635) thickness of polyester resin-based powder coating by electrostatic spray process. Bake finish for 20 minutes at 450°C (232°C) metal temperature. Color shall be GREEN as selected by Architect from manufacturer's full range of standard colors.

2.03 GATES

- A. Ornamental picket swing gates in same style configuration and height as specified fencing.
- B. Gate posts shall be of extra heavy-duty construction and size to adequately support each specified gate leaf size without sag.
- C. Provide panic hardware at non-vehicular gates.

2.04 ACCESSORIES

- A. Rail Attachment Brackets – Monumental Iron Works Pro-Arc swivel bracket with up to 30 degree swivel (up/down/left/right) or approved equal). Bracket to fully encapsulate rail end for complete security that is aesthetically pleasing. Note to Bidder: District has standardized on this specific bracket and requires it to be used regardless of which fence panel manufacture is submitted on. Bid accordingly.
- B. Industrial Drive Rivets: Of sufficient length to attach items in a secure non-rattling position. Rivet to have a minimum of 1100 lbs. (4894 N) holding power and a shear strength of 1500 lbs. (6674 N).
- C. Ornamental Picket Fence Accessories: Provide indicated items required to complete fence system. Galvanize each ferrous metal item in accordance with ASTM B695 and finish to match framing.
- D. Post Caps: Formed steel, cast of malleable iron or aluminum alloy, weathertight closure cap. Provide one flat style post cap for each post.
- E. Picket Tops: Flat top with polymer plug.
- F. Hinges: Provide heavy-duty weld hinges of size capable of supporting specified leaf width without sag or failure. Gorilla hinge or equal.
- G. Locking Clasps: Provide heavy-duty hardware to receive padlock at location where gate leaves meet each other or strike post.
- H. Padlocks: Padlocks are provided by District. Contractor to provide necessary padlock quantity to District. Once provided by Owner, Contractor shall re-key to match specific site keying.
- I. Cane Bolt: Provide heavy-duty cane bolt at all 2-leaf gate configurations. Provide at each leaf to secure each leaf into pavement below. Cane bolt shall be capable of being raised and locked in the retracted position when not in use. Provide 12 inch galvanized sleeve receivers encased with 12 inch round concrete in the close and open position. Cane bolts to freely drop and lift in the closed and open position.
- J. Knox Box: Model 3200 series, black. Fully weld to gate frame. Prime and paint affected finish. Location and quantity as shown on drawings. Boxes located at frontage of school shall have a reflective red adhesive sticker on front of lock body. Boxes located at other locations not on main school frontage shall have a reflective green adhesive sticker on front of lock body.
- K. Knox Locks: Model 3700 series, stainless steel, exterior use. Provide at all maintenance gates and fire apparatus gates along fire lane. All locks shall have a reflective green adhesive sticker around lock body.

2.05 SETTING MATERIAL

- A. Concrete: Minimum 28-day compressive strength of 3,000 psi.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify areas to receive fencing are completed to final grades and elevations.
- B. Ensure property lines and legal boundaries of work are clearly established.

3.02 INSTALLATION

- A. Install fence in accordance with manufacturer's instructions.
- B. Space posts uniformly not to exceed a full panel width. Face of post to closest picket not to exceed 3-7/8 inch spacing.
- C. Concrete Fence Set Posts: 24" min. \emptyset x36" min. deep or as otherwise indicated on drawings.
- D. Concrete Gate Swing Posts: Provide reinforced concrete footings as indicated on the Drawings.
- E. Check each post for vertical and top alignment and maintain in position during placement and finishing operation.
- F. Align fence panels between posts. Firmly attach rail brackets to posts with 1/4" (6 mm) bolt and lock nut, ensuring panels and posts remain plumb.
- G. Position bottom of picket 2 inches above existing/new finished grade. Distance from picket on each end of panel to the support post shall not be greater than 4".
- H. Where touch up paint is necessary, paint shall match powder coated finish. Unacceptable finishes will require re-powder coating.
- I. Cutting of manufacturer's brackets will not be accepted.

3.03 GATE INSTALLATION

- A. Install gates plumb, level and secure for full opening without interference.
- B. Attach hardware by means, which will prevent unauthorized removal.
- C. Adjust hardware for smooth operation.
- D. All gates with panic hardware to be third-party shop fabricated in a certified shop along with adjacent posts and header. Galvanized and powder coated finishes.
- E. Welding: All welds shall be shop fabricated prior to galvanizing unless otherwise acceptable to Owner's representative. And all field welds shall be completed by a Certified Structural Welder and shall be

“spray-galvanized” or otherwise treated subject to the discretion of the Owner’s Representative.

1. All field welding to be performed by a certified welder and all welds are to be ground down smooth.
2. All areas of welds are to be thoroughly cleaned and treated with two coats of cold galvanized spray.
3. All hinges shall be welded to the gate post.

3.04 ACCESSORIES

- A. Install post caps and other accessories to complete fence. Post caps shall be riveted to post with two rivets on opposite sides of post.

3.05 CLEANING

- A. Clean up debris and unused material and remove from site.

3.06 ADDITIONAL SUPPLIED ITEMS

- A. Provide a bag of rivets to District.
- B. Provide (4) additional 10 feet long 4 inch square tubing posts.
- C. Provide twenty additional brackets to District.

END OF SECTION

SECTION 32 80 00

IRRIGATION

PART 1 - GENERAL

Construction Documents and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.01 SUMMARY

A. DESCRIPTION

1. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the installation of an automatic sprinkler irrigation system, including all piping, sprinkler heads, controls, connections, testing, etc. as shown on the Drawings and as specified herein. The water source for this project is potable water.
2. Utilize and accept as standards manufacturer's recommendations and/or installation details for any information not specifically detailed on the Drawings.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 03 10 00 - Concrete Forming.
3. Division 26 – Electrical.
4. Section 31 00 00 – Earthwork.
5. Section 32 16 00 - Site Concrete.
6. Section 32 90 00 – Landscaping.

1.02 SUBMITTALS

- A. Comply with requirements of Section 01 33 00 – Submittal Procedures.
- B. Product names are used as standards; provide proof as to equality of any proposed material and do not use other materials or methods unless approved in writing by the Owner's Representative. Submit no more than one request for substitution for each item. The decision of the Owner's Representative is final.
- C. Use equipment capacities specified herein as the minimum acceptable standards.
- D. List materials in the order in which they appear in Specifications; include substitutions. Submit the list for approval by the Owner's Representative.

- E. Make any mechanical, electrical, or other changes required for installation of any approved, substituted equipment to satisfaction of Owner's Representative and without additional cost to Owner. Approval by Owner's Representative of substituted equipment and/or dimensional drawing does not waive these requirements.
- F. Do not construe approval of material as authorization for any deviations from Specifications unless attention of Owner's Representative has been directed to specified deviations.
- G. Record Drawings: Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work exactly as installed
 - 1. Regularly update plans of the system and any changes made to the system throughout the project. Record all changes on this plan before trenches are backfilled.
 - 2. Record the as-built information on reproducible plans provided by the Architect. Complete and submit the Record Drawings to the Architect before applying for payment for work installed.
 - 3. As-built drawings are to be completed electronically with a pdf editing software or computer aided drafting software. As-built drawing done by hand will not be accepted for final submittal.
 - 4. Show the following on the Record Drawings accurately to scale and dimensioned from two permanent points of reference:
 - a. Distance of mainline from nearby hardscape.
 - b. Location of automatic control valves, quick couplers, and gate valves.
 - c. Location and size of all sleeves.
 - d. Location of automatic control wires and spares.
- H. Operation Manuals: Deliver two complete sets of manufacturer's warranties, Contractor guarantees, instruction sheets, parts lists and operation manuals to the Architect before requesting final acceptance of the project. Do not request final inspection until the sets are approved.

1.03 QUALITY ASSURANCE

- A. Qualifications of Contractor: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+\ - 20% of the construction cost) and scope for education campuses. Contractor to have a minimum of two projects either completed or in construction in the last five years.
- B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.
- C. Reviews: Specifically request reviews of all items listed below in "Inspection Requirements" prior to progressing to the next level of work.
- D. Certification: Ensure that the contractor installing the Central Control System is trained and certified in the installation of the Central Control System. The training and certification must have been completed within two years prior to the installation date.

- E. Standards:
1. Provide work and material in full accordance with the rules and regulations of the California Electric Code; the California Plumbing Code; and other applicable state or local laws or regulations.
 2. Furnish, without extra charge, additional material and labor required to comply with these rules and regulations, though the work may not be specifically indicated in the Specifications or Drawings.
 3. Where the Specification requirements exceed those of the above-mentioned codes and regulations, comply with the requirements in the Specifications.
- F. Comply with the requirements of Section 01 77 00 – Closeout Procedures.
- G. Inspection Requirements
1. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner’s Representative, and the Landscape Architect.
 2. Prior to commencement of the work of this Section, obtain written verification from the project Civil Engineer that the rough grade in landscape areas is in conformance with Section 31 00 00 - Earthwork.
 3. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:
 - a. Pressure testing of all mainlines and lateral lines (See “Hydrostatic Tests – Open Trench” in Part 3.05 of this Section),
 - b. Trench depth,
 - c. Sleeves under pavement,
 - d. Flushing of all mainlines and lateral lines,
 - e. Installation of Leemco joint restraints and bolts,
 - f. Backfill and pipe bedding,
 - g. Layout of heads,
 - h. Operation of system and coverage adjustments (with Landscape Architect) after system is fully automated and operational, backfill of trenching is completed, and surface has been restored to original grades.
 4. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect related work and material.
- B. Handle plastic pipe carefully, especially protecting it from prolonged exposure to sunlight. Store pipe on beds that are the full length of the pipe, and keep pipe flat and off the ground with blocks.

1.05 PROJECT/SITE CONDITIONS

- A. Information on Drawings relative to existing conditions is approximate. During progress of construction, make deviations necessary to conform to actual conditions, as approved by Owner's Representative, without additional cost to Owner. Accept responsibility for any damage caused to existing services. Promptly notify Owner's Representative if services are found which are not shown on Drawings.
- B. Protect existing utilities within construction area. Repair damages to utility lines that occur as a result of operations of this work.
- C. Verify dimensions at building site and check existing conditions before beginning work. Make changes necessary to install work in harmony with other crafts after receiving approval by Owner's Representative.

1.06 WARRANTY

- A. Guarantee all workmanship and materials hereunder against defective workmanship and materials, including damage by leaks and settlement of irrigation trenches, for the duration specified in Division 01 of these Specifications. (The Contractor is not responsible for vandalism or theft after date of final acceptance.)

1.07 SYSTEM STARTUP

- A. Booster Pump:
 - 1. Order booster pump as soon as possible to avoid delays in the project.
 - 2. After booster pump and electrical connections have been installed, power has been made available, the downstream irrigation system has been pressure-tested, heads have been set, and trenches have been backfilled and compacted, request that the booster pump manufacturer's technician participate in and/or direct the start-up of the booster pump. Start-up shall include all testing and settings for the following:
 - a. Flow
 - b. Pressure
 - c. Connections
 - d. Electrical currents
 - e. Wire connections
 - f. Pump installation
 - 3. Upon successful completion of testing by the booster pump technician, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
- B. Central Control System
 - 1. Install controllers, master valves, flow sensors, ground system, wiring, cables, Ethernet and any other components not shown on the Drawings.

2. Request that the manufacturer's representative participate and/or direct the start-up of the Central Control System. Start-up shall include all testing and settings for the following:
 - a. Flow sensor
 - b. Grounding
 - c. Wire connections
 - d. Pump start
 - e. Bypass
 - f. Overall instruction
3. Upon successful completion of testing by the technician from supplier, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
4. Run the system; record the flows per valve and report them to the Owner's Representative.

1.08 MAINTENANCE

- A. Furnish three complete sets of operating maintenance instructions bound in a hardback binder and indexed. Start compiling data upon approval of list of materials. Do not request final inspection until booklets are approved by Owner's Representative.
- B. Incorporate the following information in these sets:
 1. Complete operating instructions for each item of irrigation equipment.
 2. Typewritten maintenance instructions for each item of irrigation equipment.
 3. Manufacturer's bulletins which explain installation, service, replacement parts, and maintenance.
 4. Service telephone numbers and/or addresses posted in an appropriate place as designated by Owner's Representative.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use materials as specified; any deviation from the Specifications must first be approved by the Owner's Representative in writing. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.
- B. Automatic Controller: as indicated on Drawings.
- C. Master Valves and Flow Sensors: as indicated on Drawings.
- D. Automatic Control Valves: as indicated on Drawings.
- E. Drip Control Kit: as indicated on Drawings.
- F. Gate Valve: as indicated on Drawings.

- G. Pipe and Fittings:
1. PVC pipe: for all mainline and lateral lines, PVC schedule 40 up to 3" size and PVC Class 200 gasketed for 4" and larger.
 2. PVC fittings for mainline two inches (2") and smaller and all lateral lines: High impact, standard weight, Schedule 40, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal.
 3. Ductile iron fittings for all mainline fittings two and one-half inches (2 ½") and larger: Leemco joint restraint fittings or approved equal.
 4. All plastic pipe and fittings: Continuously and permanently marked with manufacturer's name, type of material, IPS size, schedule, NSF approval, and code number.
 5. Threaded PVC pipe and nipples: IPS Schedule 80 when necessary to use threaded connections to gauges, valves, or control valves. Threaded adapters may be used in place of nipples when making pipe to valve connections.
 6. Use 45-degree fittings for changes in depth of pipe, and at transition from main line to automatic control valves.
 7. Piping above ground: Schedule 40 galvanized steel with cast-iron fittings.
 8. Piping used for electrical purposes to be Schedule 40 PVC Rigid Nonmetallic Conduit electrical conduit.
- H. Booster Pump: as indicated on Drawings.
- I. PVC Primer: Weld-On P-70 Purple Primer or approved equal.
- J. PVC Glue: Weld-On 711 Gray heavy bodied PVC Cement or approved equal.
- K. Sprinkler Heads: as indicated on Drawings.
- L. Quick Coupler Valves: Rainbird 44np or approved equal.
- M. All Valve Boxes and Covers: Concrete manufactured with steel checker plate lid with "Irrigation – Non-Potable" permanently embossed on cover. Christie or approved equal.
- N. Automatic Sprinkler Control Wire:
1. Connections between remote control valves and controller: 14 AWG direct burial plastic polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Common wire to be white, and lead wire to be colored. If multiple controllers are used, a different color is to be used for each controller's lead wire. (Use red for the first controller). Spare wires are to be yellow.
 2. UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
 3. Provide adequate working space around electrical equipment in compliance with local codes and ordinances.
 4. Electrical, other than low voltage, such as power wiring, conduit, fuses, thermal overloads and disconnect switches, is included under Division 26 of these Specifications.

- O. Trace Wire:
1. Direct burial #12 AWG Solid, steel core soft drawn tracer wire, 250# average tensile break load, 30 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30-volt rating. Color shall be green.
 2. Connectors: UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
- P. Master Valve and Flow Sensor Wire:
1. Master valve wires are to be 14 AWG direct burial plastic polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Wire color to be blue for the lead and white for the common. If there are two master valves, the second master valve wire is to be blue/white striped for the lead and white for the common.
 2. Flow sensor wires are to be 14 AWG direct burial plastic polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Wire color to be black for the lead and white for the common. If there are two flow sensors, the wires leading to each flow sensor is to be a different color.
- Q. Unions And Flanges:
1. Steel unions and flanges two inches (2") and smaller: 150 lb. screwed black (brass to iron seat) or galvanized malleable iron (ground joint).
 2. Steel unions and flanges two and one-half inches (2 ½") and larger: 150 lb. black flange union, flat-faced, full gasket.
 3. Gaskets: One-sixteenth inch (1/16") thick rubber Garlock No. 122, Johns-Manville or approved equal.
 4. Flange Bolts: Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper-plated steel bolts and nuts or brass bolts and nuts for brass flanges.
- R. Pipe Supports: Adjustable saddle support type support.
- S. Valve Identification Tags: Christy's irrigation ID tags, standard yellow color or approved equal.
- T. Sand for Trench Backfill: Natural sand, free of roots, bark, sticks, rags, or other extraneous material.

PART 3 - EXECUTION

3.01 EXAMINATION

Locations of existing utilities and other improvements shown on the Drawings are approximate. Verify existing conditions and, should any utilities be encountered that are not indicated on the plans, notify the Owner's Representative immediately. Accept responsibility for any damages caused to existing services.

3.02 PREPARATION

- A. Scheduling: Notify the Project Inspector prior to commencing and/or continuing the work of this Section. Remove and replace, at no cost to Owner, any work required as a result of failure to give the appropriate notification.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.
- D. Protection: Maintain warning signs, shoring and barricades as required. Prevent injury to, or defacement of, existing improvements. At no additional cost to Owner, repair or replace items damaged by installation operations.
- E. Existing Tree Protection:
 - 1. Avoid unnecessary root disturbance, compaction of soils within drip line, or limb breakage.
 - 2. Do not store material or dispose of any material other than clean water within the drip line.
 - 3. Provide adequate irrigation during construction.
 - 4. Replace any tree damaged during construction with a tree of equal size and value at no additional cost to Owner.
 - 5. Adjust trench locations in field to minimize damage to existing elements and plant roots of trees-to-remain at no additional cost to Owner.
- F. Surface Preparation: Prior to beginning sprinkler irrigation work, complete placement of topsoil as specified in Section 31 00 00 – Earthwork. Notify Project Inspector of irregularities if any.

3.03 INSTALLATION

- A. Automatic Controller
 - 1. Automatic Controller: Install system and components as per Drawings and manufacturer's recommendations. All wiring connections shall be neatly accomplished within the controller cabinet. Connect Ethernet and grounding system as per manufacturer's recommendations.
 - 2. Connect automatic control valves to controller(s) in sequence as shown on Drawings.
 - 3. Install all exposed wires to a minimum of twenty-four inches (24") beyond controller within a UL approved rigid conduit.
- B. Master Valves and Flow Sensor
 - 1. Master Valve: Install as per manufacturer's recommendation. Connect master valve wiring to the automatic controller. Install wire in a conduit. Wire is not to have any splices between the valve and the controller.

2. Flow Sensor: Install as per manufacturer's recommendation. When using a "saddle" installation, install at the correct depth in the pipe and orientate the paddle properly for accurate reading of flow. Connect flow sensor wire to the automatic controller. Install wire in a conduit. The wire is not to have any splices between the valve and the controller.

C. Booster Pump Assembly

1. Booster Pump: Install as per manufacturer's directions and as detailed on Drawings. Lay out piping in field for exact locations and/or connections.
2. Booster Pump Pad: Install on a level, raised utility pad so booster pump is set level. Encase anchor bolts in the concrete pad.
3. Piping Assembly: Lay out system plumb and level. Paint entire assembly, including the pipe supports. Use metal pipe for all exposed pipe and extend below the ground to the horizontal main line pipe.
4. Coordination: Lay out conduit for electrical components to minimize conduit above grade.

D. Control Wires

1. General: Install control wires beneath sprinkler main line whenever possible; tape wires to mainline pipe. Provide one spare wire for each controller.
2. Slack Wire: Provide eighteen inches (18") of slack wire for each wire connected to automatic control valve. Slack wire shall be coiled and left in the valve box. Tape wires in bundles every ten feet (10'); do not tape wires in sleeves.
3. Expansion and Contraction: Snake wire in trench to allow for contraction of wire.
4. Wire Passing Under Existing or Future Paving or Construction: Encase in PVC Schedule 40 or galvanized steel conduit extending at least twelve inches (12") beyond edges of paving or construction.
5. Wire Connections: Install wire connections in a waterproof sealing pack.
6. Wire Splicing: Permit splicing only on runs exceeding 500 feet. Locate all splices within valve boxes.
7. Wire Termination: Install wire in a valve box with eighteen inches (18") of slack wire coiled and individually capped with approved waterproof sealing pack.
8. Spare Wire: Install two (2) spare wires along each wire path. If there is more than one wire path from the controller, the contractor to install two (2) spare wires per path. Provide eighteen inches (18") of slack wire at each automatic control valve.

E. Trace Wire

1. General: Install trace wire above sprinkler main line whenever possible; tape wire to mainline pipe at 10' intervals to ensure the wire remains adjacent to the pipe.
2. Wire Connections: Install wire connections in a waterproof sealing pack.
3. Trace wire access points shall be accessible at all automatic control valves.
4. At all mainline end caps, a minimum of six feet (6') of tracer wire shall be coiled and secured to the cap for future connections. The end of the tracer wire shall be spliced to the wire of a six-pound zinc anode and is to be buried at the same elevation as the irrigation mainline.

5. Testing: The contractor shall perform a continuity test on all trace wires in the presence of the client. If the trace wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire.

F. Automatic Control Valves and Quick Coupler Valves

1. Install where shown and where practical; place no closer than twelve inches (12") to walk edges, building walls, or fences. Refer to detail for example.
2. Thoroughly flush mainline before installing valve.
3. Install valves in ground cover areas where possible.

G. Piping

1. General: Install in conformance with reference standards, manufacturer's written directions, as shown on Drawings and as herein specified.
2. Workmanship:
 - a. General: Install sprinkler irrigation equipment in planted areas throughout the site.
 - b. Coordination: Organize location of sleeves with other trades as required.
3. Pipeline Assembly:
 - a. General:
 - 1.) Cutting: Cut pipe square; remove rough edges or burrs.
 - 2.) Solvent-welded Connections: Use materials and methods recommended by the pipe manufacturer.
 - 3.) Brushes: Use non-synthetic brushes to apply solvents and primer.
 - 4.) Cleaning: Clean pipe and fittings of dirt, moisture, and debris prior to applying solvent or primer.
 - 5.) Assembly: Allow pipe to be assembled and welded on the surface or in the trench.
 - 6.) Expansion and Contraction: Snake pipe from side to side of trench to allow for expansion and contraction.
 - 7.) Location: Locate pipes as shown on Drawings except where existing supply valves, utilities or obstructions prohibit or where slight changes are approved to better suit field conditions.
 - b. Elastomeric Seal (Gasket) Joints:
 - 1.) General: Assemble in strict conformance with the pipe manufacturer's instruction.
 - 2.) Rubber Rings: Use rubber rings specific for water service systems.
 - 3.) Cleaning: Thoroughly clean ring and groove of dirt, moisture and debris using a clean, dry cloth. Do not use solvents, lubricants, cleaning fluids or other material for cleaning.
 - 4.) Seating: Properly seat ring in groove.
 - 5.) Spigot: Clean spigot-end of pipe as in "Cleaning" above prior to applying lubricant recommended by pipe manufacturer. Insert spigot into bell and seat to full depth required.

- c. Connections:
 - 1.) Threaded Plastic Pipe Connection:
 - a) Use Teflon tape or pipe joint compound.
 - b) When assembling to threaded pipe, take up joint no more than one full turn beyond hand-tight
 - 2.) Metal Valves and Plastic Pipe: Use threaded plastic male adapters.
 - 3.) Metal to Metal Connections:
 - a) Use specific joint compound or gasket material for type of joint made. Where pipe of dissimilar metals are connected, use dielectric fittings.
 - b) Where assembling, do not allow more than three full threads to show when joint is made up.
 - 4.) Where assembling soft metal (brass or copper) or plastic pipe, use strap-type friction wrench only; do not use a metal-jawed wrench.
 - 5.) Threading:
 - a) Do not permit the use of field-threading of plastic pipe or fittings. Use only factory-formed threads.
 - b) Use factory-made nipples wherever possible. Permit the use of field-cut threads in metallic pipe only where absolutely necessary. When field-threading, cut threads accurately on axis with sharp dies.
 - c) Use pipe joint compound for all threaded joints. Apply compound to male thread only.
- d. Sleeves and conduits:
 - 1.) Use sleeves of adequate size to accommodate retrieval for repair of wiring or piping and extend a minimum of twelve inches (12") beyond edges of walls or paving.
 - 2.) Provide removable, non-decaying plug at end of sleeve to prevent entrance of soil.
- e. Unions: Locate unions for easy removal of equipment or valve.
- f. Joint Restraints: Install per manufacturer's recommendations.
- g. Capping: Plug or seal opening as lines are installed to prevent entrance materials that would obstruct pipe. Leave in place until removal is necessary for completion of installation.
- h. Drip Irrigation Tubing: Install as per Drawings.

H. Sprinkler Heads

- 1. Sprinkler heads: Locate as shown on the Drawings except where existing conditions prohibit, or slight changes are approved to achieve as good or better coverage under the same conditions. Do not allow sprinkler head spacing to exceed the maximum shown on the Drawings. Plumb heads.
- 2. Handling, Assembly of Pipe, Fittings, and Accessories: Allow only skilled tradesmen to handle and assemble pipe, fittings and equipment. Keep interior of pipes, fittings and accessories clean at all times. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation. Do not permit bending of pipe.

3. Flushing: Remove end heads and operate system at full pressure until all rust, scale, and sand is removed. Divert water to prevent ponding or damage to finished work.
4. Coverage: Accept responsibility for full and complete coverage of irrigated areas to satisfaction of Landscape Architect and make necessary adjustments to better suit field conditions at no additional costs to Owner.

3.04 CONSTRUCTION

A. Grading

Install all irrigation features to their finished grade and at depths indicated. Complete and /or accommodate all rough grading and/or finish grading before commencing with trenching.

B. Layout

1. Lay out work as accurately as possible to Drawings. Drawings are generally diagrammatic to extent that swing joint offsets and fittings are not shown. Record all changes on the Record Drawings.
2. Do not willfully install the irrigation system as shown on Drawings when it is obvious, in the field, that obstructions or other discrepancies exist which may not have been considered in the design. Notify Owner's Representative of discrepancies before proceeding.

C. Excavating And Trenching

1. General: Perform excavations as required for installation of work included under this Section, including shoring of earth banks to prevent cave-ins. Restore surfaces, existing underground installations, etc., damaged or cut as result of this work to their original condition and in a manner approved by the Landscape Architect.
2. Width:
 - a. Make trenches wide enough to allow a minimum of six inches (6") between parallel pipelines and three inches (3") between side of pipe and side of trench. Do not allow stacking of pipe within trench.
 - b. Allow a minimum clearance of twelve inches (12") in any direction from parallel pipes of other trades.
3. Preparation of Excavations: Remove rubbish and rocks from trenches. Bed pipe on a minimum of three inches (3") of clean, rock-free soil to provide a firm, uniform bearing for entire length of pipeline. Cover pipe with a minimum of three inches (3") of clean, rock-free soil. If clean, rock-free soil is not available, use sand for pipe bedding and three inches (3") of backfill above the pipe. The remainder of the trench backfill material can be native soil. Do not allow wedging or blocking of pipe.
4. Minimum depth of cover: Unless shown otherwise, provide the following minimums:
 - a. Mainline: twenty-four inches (24") cover.
 - b. Lateral line: twelve inches (12") cover for spray heads, and eighteen inches (18") cover for rotor heads.
5. Conflicts with other trades:
 - a. Hand-excavate trenches where potential conflict with other underground utilities exist.

- b. Where other utilities interfere with irrigation trenching and piping work, adjust the trench depth as instructed by Owner's Representative.

D. Backfill And Compacting

1. General: Do not begin until hydrostatic tests are completed. When system is operating and after required tests and inspections have been made, backfill trenches under paving areas to the compaction rate specified in Section 31 00 00 – Earthwork.
2. Place backfill in six-inch (6") layers and compact with an acceptable mechanical compactor.
 - a. Compact backfill material in landscape areas to eighty-five percent (85%) maximum dry density of the soil.
 - b. If settlement occurs along trenches, make adjustments in pipes, valves, and sprinkler heads, soil, sod or paving as necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, without additional cost to the Owner.
3. Excess Soil: Remove all rocks, debris, and excess soil that results from sprinkler irrigation trenching operations, landscape planting, and soil preparation operations off site at no additional cost to the Owner. If soil meets topsoil requirements in Section 31 00 00 – Earthwork, it may be used for finish grading.
4. Finishing: Dress-off areas to eliminate construction scars.

E. Flushing Lines

1. Thoroughly flush lines prior to installing valves, performing hydrostatic testing, or installing sprinklers. Divert water to prevent washouts.

F. Concrete Work

1. Underground anchors and pads for valves boxes are included under this Section of Specifications. Concrete shall have a minimum strength of 2500 psi. The slump test shall be a four inch (4") maximum slump. At twenty-eight days, the concrete shall have a minimum strength of 2500 psi. Use materials and mix in accordance with ASTM C 94. Refer to Section 32 16 00 - Site Concrete.

3.05 FIELD QUALITY CONTROL

- A. Visual Inspection: Verify that all pipe is homogenous throughout and free from visual cracks, holes, or foreign materials. Inspect each length of pipe. All materials are subject to impact test at the discretion of the Landscape Architect.
- B. Hydrostatic Tests – Open Trench:
 1. Center-load piping with a small amount of backfill to prevent arching or slipping under pressure.
 2. Request the presence of the Project Inspector in writing at least forty-eight hours in advance of testing.
 3. At no additional cost to Owner, test in the presence of the Project Inspector.

4. Apply continuous static water pressure of 100 psi when welded plastic joints have cured at least twenty-four hours, and with the risers capped, as follows: test main lines and submains for four hours; test lateral lines for two hours.
 5. Repair leaks resulting from tests; and repeat tests.
 6. Test to determine that all sprinkler heads function according to manufacturer's data and give full coverage according to intent of Drawings. Replace any sprinklers not functioning as specified with ones that do, or otherwise correct system to provide satisfactory performance.
- C. Continuity Testing: Test locating device and control wires for continuity prior to and after back-filling operations.

3.06 ADJUSTING

- A. Adjusting System: Prior to acceptance, satisfactorily adjust and regulate entire system. Set watering schedule on controller appropriate to types of plants and season of year. Adjust remote control valves to operate sprinkler heads at optimum performance based on pressure and simultaneous demands through supply lines.
- B. System Layout: Provide reduced prints of Record Document irrigation plans, laminated in four (4) mil. plastic, of size to fit controller door. Enlarge remote-control valve designations as necessary for legibility. Color-code areas covered by each station. Affix plans to inside of controller door.
- C. Instructions: Upon completion of work, instruct maintenance personnel on operation and maintenance procedures for entire system.
- D. Flow Charts: Record and prepare an accurate flow-rate chart for each automatic control valve.

3.07 CLEANING

Remove debris resulting from work of this Section.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the following work as specified herein:
2. Soil Preparation and Fertilization
3. Planting
4. Sodding
5. Weed Control
6. Imported Topsoil
7. Mulch
8. Engineered Wood Fiber
9. Clean-up
10. Landscape Maintenance Period
11. Guarantee
12. Work not included in this Section: Landscape elements such as concrete walks, fencing, outdoor lighting, rough grading, and clearing are not a part of this Section unless shown on the landscape Drawings.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 31 00 00 – Earthwork.
3. Section 32 15 00 – Aggregate Surfacing.
4. Section 32 80 00 – Irrigation.

1.02 SUBMITTALS

A. See Section 01 33 00 – Submittals, for additional requirements.

B. Plant Material: Within fifteen (15) days after award of contract, locate plant materials required for construction. Ensure that trees and shrubs are contract-grown from a certified nursery. Notify Owner's Representative of plant material "tied off" for review at selected nursery. If specified material is not obtainable, submit the following to Owner's Representative: proof of non-availability, proposal for use of equivalent material, photographs of alternative choices of plant material. Include clear, written description of type, size, condition, and general character of plant material.

- C. Data Sheets: Provide product data for each type of landscape material indicated in the Drawings and Specifications.
- D. Samples: Submit samples of the following materials to Landscape Architect for approval:
 - 1. Soil amendment: (3) one-quart zip-locked plastic bags.
 - 2. Bark Mulch: (3) one-quart zip-locked plastic bags.
 - 3. Imported Topsoil: (3) one-quart zip-locked plastic bags. (if needed)
- E. Provide soils analysis reports prepared by a qualified soils laboratory in compliance with the Soil Testing Requirements under "Soil Testing" in Part 3.02 of this Section.
- F. Prior to planting, submit copies of all trucking or packaging tags for all soil amendment, fertilizer and other additives to Landscape Architect so the quantities can be verified.
- G. Record Drawings: Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work exactly as installed.

1.03 QUALITY ASSURANCE

- A. Qualifications: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+\ -20% of the construction cost) and scope for education campuses. Contractor to have a minimum of two projects either completed or in construction in the last five years.
- B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.
- C. Reviews: Specifically request reviews of all items listed below in "Inspection Requirements" prior to progressing to the next level of work. The Owner's Representative reserves the right to inspect and reject material, both at place of growth and at site, before and/or after planting, for compliance with requirements for name, variety, size and quality.
- D. Reference Standards: Meet or exceed Federal, State and County laws requiring inspection of all plants and planting materials for plant disease and insect control.
- E. Delivery, Storage, and Handling:
 - 1. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
 - 2. Bulk Materials:
 - a. Do not dump or store bulk materials near structures, utilities, walkways or pavements, or on existing turf areas or plants.

- b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
- c. Accompany each delivery of bulk fertilizers, and soil amendments with appropriate certificates.

F. Plant Material:

1. Conform to the current edition of Horticultural Standards for quality of Number 1 grade nursery stock as adopted by the American Association of Nurserymen. Conform to sizes specified on plant legend. Select plants which have a natural shape and appearance.
2. Select only plants that are true to name, and tag one of each bundle or lot with the name of the plant in accordance with the standards of practice of the American Association of Nurserymen. In all cases, botanical names shall take precedence over common names.
3. Tag each plant of a patented variety with the variety and identification number, where applicable, as it is delivered to the job site.
4. Select only plants which have been nursery-grown in accordance with good horticultural practices and which have been grown under climatic conditions similar to those in the locality of the project for at least one year.
5. Select only plants which are typical of their species or variety; have normal habits of growth; are sound, healthy, vigorous, well-branched and densely-foliated when in leaf; are free of disease, insect pests, eggs or larvae; and have a healthy and well-developed root system.
6. Select only container stock that has been grown in the containers in which delivered for at least six (6) months, but not over two (2) years. Provide samples to show that there are no root-bound conditions.
7. Do not use plants that are severely pruned or headed-back to meet size requirements.
8. Do not plant container-grown plants that have cracked or broken balls of earth when taken from the container. Remove canned stock carefully from cans after containers have been cut on two sides with tin snips or other approved cutter.
9. Coordinate a time for the Landscape Architect to inspect the plants upon their delivery to the project site.
10. At any time prior to final acceptance, be prepared to replace any plants that are rejected by the Owner's Representative because of physical damage to the plant.
11. Do not remove container-grown stock from containers before time of planting.
12. Be prepared to replace plants which are rejected by the Owner's Representative for the following reasons:
 - a. Trunk bark damage caused by sunburn,
 - b. Trunk bark wounds caused by rubbing stakes or ties,
 - c. Trunk bark damage caused by ties that have girdled the tree,
 - d. Tree head development that is lopsided and not symmetrical in form,
 - e. Tree branches that cross or touch,
 - f. Tree branches with double leaders (unless multi-trunk trees are specified).
13. Stake shrubs with one-inch by one-inch by eighteen-inch (1"x1"x18") stakes in such manner that the stakes are not visible, and tie to upright position if they lean and/or are not growing in a vertical position.

14. Furnish quantities necessary to complete the work as shown on the Drawings and, if necessary, make up for any discrepancies in the quantities given in the Plant List at no additional cost to Owner.

G. Comply with the requirements of Section 01 77 00 – Contract Closeout and Final Cleaning.

1.04 INSPECTION REQUIREMENTS

A. Landscape Architect reserves the right to examine and reject plant material both at place of growth and at site, before and after planting, for compliance with requirements of name, variety, size, and quality.

B. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner's Representative, and Landscape Architect.

C. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:

1. Rough grading is to tolerances specified in Section 31 00 00 – Earthwork.
2. The placement of landscape backfill material is as specified in this Section.
3. Prior to the commencement of the work specified in this Section, the coverage and operation of the sprinkler irrigation system are as specified in Section 32 80 00 - Irrigation.
4. The soil amendment and topsoil does not include any metal fragments. (Obtain a letter from the manufacturer stating that the material submitted for use on this project has no metal or foreign objects. Submit this letter as part of the Data Sheet submittal package [see "Submittals and Substitutions" in this Section])
5. Required Test: For each load of soil amendment delivered to the site, spread at least two cubic yards (2 cy) of material onto a paved surface approximately two inches (2") deep. Pass a magnetic rake over the material in two directions. If any metal is found, test the entire load in the same manner. Perform all testing in the presence of the Project Inspector.
6. Soil amendments, fertilizer, bark mulch and materials used for hydroseeding have been delivered to the site by the supplier, the invoices from the supplier indicate the project name and quantities delivered, and the Project Inspector has received copies of all such documents.
7. Prior to planting, amendments and conditioners have been incorporated as per pre-planting recommendations, and planting areas have been made ready to receive planting.

D. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

E. Beginning of Maintenance Period: Verify all work is complete, then request and hold a meeting to include the Landscape Architect, Project Inspector, Architect and Owner's Representative for authorization to begin the landscape maintenance period.

- F. End of Maintenance: Verify that all work is complete and acceptable, and that the maintenance has been completed per specifications; and continue to provide landscape maintenance until the Owner's Representative has accepted the work.

1.05 PROJECT/SITE CONDITIONS

- A. Provide protection for persons and property throughout progress of work. Use temporary barricades as required. Proceed with work in such manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel. Store materials and equipment where directed.
- B. Existing Construction: Execute work in an orderly and careful manner to protect paving, work of other trades, and other improvements.
- C. Existing Utilities: Provide protection for existing utilities within construction area. At no additional cost to Owner, repair any damages to utility lines that occur as a result of this work.
- D. Landscaping: Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods.
- E. Paving: Maintain cleanliness of paving areas and other public areas used by equipment, and immediately remove spillage; remove rubbish, debris, and other material resulting from landscaping work, leaving site in a safe and clean condition.
- F. Planting Schedule / Environmental Requirements
 1. Install, establish, and maintain all lawn areas for a minimum of ninety (90) days prior to date of substantial completion. Coordinate schedule with other work and overall project schedule. Failure to install lawn areas by this date shall result in assessment of liquidated damages.
 2. Proceed with work in an orderly and timely manner to complete installation of landscaping within contract limits.
 3. Planting Season Limits: Do not plant when grounds are wet or temperature is below 25° F. Do not proceed with any soil preparation and fertilization if all planting cannot be completed within Planting Season Limit.

1.06 WARRANTY

- A. The guarantee period for lawn and plant material shall be the duration of the landscape maintenance period, from commencement until final acceptance of the work of this Section. See Division 01 for other applicable guarantee requirements.

- B. During the guarantee period, repair and/or replace plants and lawn not in satisfactory growing condition, as determined by Owner's Representative, without additional cost to Owner. Plants are to be replaced as per "Landscape Maintenance" in Part 3.05 of this Section, using plants of the same kind and size specified in plant list.

1.07 MAINTENANCE

- A. Beginning of Landscape Maintenance Period:

1. General: Landscape Maintenance Period does not begin until all work is installed, as determined by Landscape Architect, in writing.
2. Booster Pump: Upon successful completion of testing by the booster pump technician, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
3. Automatic Controller: Upon successful completion of testing by the technician from Hunter, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
4. On-site Inspection: When all work is complete, request and hold a meeting to include the Landscape Architect, Project Inspector, Architect and Owner's Representative who must together authorize and determine the start date for the landscape maintenance period. Coordinate and give notice of the date and time of the on-site meeting to all parties at least forty-eight (48) hours in advance.
5. Acceptability: In cases where the lawn has reached adequate fullness and germination in some areas but not all, and authorization has not been given to begin the maintenance period, proceed with mowing, trimming, spraying, etc., as necessary prior to the beginning of the maintenance period.

- B. Duration of Landscape Maintenance Period:

The Landscape Maintenance Period shall continue for a minimum of ninety (90) calendar days. During this time, continuously maintain all areas involved until final acceptance of the work by the Owner's Representative. See Landscape Maintenance Period procedure in Part 3.05 of this Section.

- C. Final Acceptance of the Landscape Maintenance Period:

Request the final inspection forty-eight (48) hours in advance. If items require attention, hold on-site meetings until Landscape Architect can certify, in writing, and in concurrence with the Owner's Representative, the successful completion of the Landscape Maintenance Period.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use material in new and perfect condition as specified. Any deviations or substitutions from the Specification and Drawings must first be approved by Owner's Representative in writing prior to use.
- B. Topsoil: Fertile; friable; natural loam surface soil; reasonably free of subsoil, clay lumps, brush, weeds and other litter; and free of roots, stumps, stones/rocks, and other extraneous or toxic matter harmful to plant growth.
- C. Soil Amendment: One-percent nitrogen-impregnated bark product with a ninety-percent (90%) bark base and zero to one-quarter inch (0-1/4") particle size, or approved equivalent. Do not spread until testing requirements have been satisfied.
- D. Fertilizer/Soil Conditioner: Gro-Power Plus or approved equal.
- E. Fertilizer for Trees and Shrubs: Seven-gram Gro-Power Planting Tablets (12-8-8 NPK) or approved equal.
- F. Vitamin B-1: "Superthrive", "Liquinox Start", "Cal-Liquid", or approved equal.
- G. Bark Mulch: Walk-On Bark as provided by Redi-Gro, or approved equal.
- H. Engineered Wood Fiber: MyBark ReadyPlay EWF, or approved equal.
- I. Tree-staking System: As indicated on Drawings.
- J. Pre-Emergent Weed Control: Oxadiazon, "Treeflan", "Ronstar 2G", "Surflan" (Elano Products Company), or approved equal.
- K. Seating Boulders: As indicated on Drawings.
- L. Header Boards: As indicated on Drawings.
- M. Root Barrier: As indicated on Drawings.
- N. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, three ounces per square yard (3 oz/sq. yd.) (101 g./sq. m.) minimum, composed of fibers formed into a stable network so that fibers retain their relative positions. Fabric shall be inert to biological degradation and resistant to naturally-encountered chemicals, alkalis, and acids.
- O. Nursery Plant Stock:
 - 1. As indicated on Drawings. Do not remove container-grown stock from containers until planting time. Plants shall be true to name.

2. Healthy, shapely, well-rooted, not pot-bound, free from insect pests or plant diseases and properly "hardened off" before planting. Replace plants that are not alive or are not in satisfactory growing condition, as determined by the Landscape Architect, without additional cost to Owner. The Landscape Architect may reject plants before and/or after planting.
3. Labeled. Label at least one tree and one shrub of each species with a securely-attached, waterproof tag bearing legible designation of botanical and common name.

P. Lawn Sod: TifTuf Hybrid Bermuda by Delta Bluegrass.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the site, verify grade elevations, and observe conditions under which work is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner's Representative.
- B. Proceed with complete landscape work as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required.
- C. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand-excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- D. When conditions detrimental to sod or plant growth are encountered, such as rubble fill, adverse drainage condition, or other obstructions, notify the Owner's Representative before planting.

3.02 PREPARATION

- A. Soil Testing
 1. Coordinate soil testing in an expeditious and timely manner as required for on-site topsoil materials. Contract with a soil laboratory and include cost of sampling and testing in contract price. Take one (1) sample for every 5,000 square feet of landscape area up to a maximum of six (6) samples under the direction of and in the presence of the Owner's Representative.
 2. Submit each sample, according to the quantity of soil required by testing laboratory, to a competent laboratory approved by the Owner's Representative.
 3. Provide analysis of soil samples for pH, salinity, ammonia, phosphate, potassium, calcium, magnesium, boron, and sodium levels. Provide appraisal of chemical properties, including particle size determination, and recommendations for types and quantities of amendments and fertilizers.

B. Clearing of Vegetation:

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days.
2. Clear and remove existing weeds by mowing or grubbing off all plant parts at least one-quarter inch ($\frac{1}{4}$ ") inch below surface of soil over entire areas to be planted.

C. Soil preparation:

1. Loosen soil in all planting areas, and on slopes flatter than 3:1 gradient, to a depth of six to eight inches (6" - 8") below finish grade. All debris, foreign matter, and stones shall be removed prior to the placing of any fertilizers or conditioners. Soil preparation is for all shrub planting beds, lawn hydroseeded areas and sodded lawn areas.
2. Conduct the required soil tests and instruct the lab to include a minimum of the following soil improvements in the recommendation on the soils report.
 - a. Soil Amendment: Two cubic yards (2 cy) per 1,000 square feet.
 - b. Gro-Power Plus: One hundred fifty pounds (150 lbs) per 1,000 square feet.
 - c. If the lab recommends less than six cubic yards (6 cy) of soil amendment, the excess bid amount shall be applied to the cost of any additional recommended soil improvements, or returned to the Owner as a credit
3. Apply amendments as follows, using rates recommended by the soils testing laboratory (the rates of amendments shown below are for bidding purposes only):
 - a. Fertilizer/Soil Conditioner: Broadcast 150 pounds of Gro Power Plus per 1,000 square feet in all planting areas and rototill to a depth of six to eight inches (6" - 8"). Remove from the site any rock and debris brought to the surface by cultivations. "Cultipack" all areas to receive sod or hydroseed.
 - b. Apply soil amendment to all planting areas at the rate of six cubic yards (6 cy) per 1,000 sf and rototill into the top six to eight inches (6" – 8").
4. Upon completion of finish grading, request a review and obtain approval of Landscape Architect prior to commencement of planting or hydroseeding.

D. Finish Grading for all Planting areas

1. Refer to Earthwork Specification Section for Rough Grading.
2. Grade to elevations and contours shown on Drawings. Fill low spots with landscape backfill material and grade to surface drain in manner indicated on Drawings.
3. Finish-grade so that the entire area within the contract lines has a natural and pleasing appearance as specified and as directed by Landscape Architect.
4. Adjust sprinkler heads flush to finish grade in preparation to receive hydroseeding or one-half inch above finish grade in preparation to receive sod. Reset sprinkler heads flush to grade after turf has germinated.
5. Flag the sprinkler heads and valve markers.

E. Planting Pits for Trees:

1. Excavate pits with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
2. Set container-grown stock in center of pit on earth pedestal. Separate roots and/or prune roots as directed by Landscape Architect. In hot weather, pre-wet pit. Loosen outside roots from sides and bottom of root ball. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Water after placing final layer of backfill.
3. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.
4. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

F. Planting Pits for Shrubs/Groundcover:

1. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
2. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.
3. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

3.03 INSTALLATION

A. Root Barrier

1. Root barriers location are not specifically shown on the plan. The following minimum requirements are to be met:
 - a. Install root barrier where trees are planted within sixty inches (60") of paving or other hardscape elements, such as walls, curbs, and walkways.
 - b. Install root barrier continuously for a distance of five feet (5') in each direction from the tree trunk, for a total distance of ten feet (10') per tree. If trees are spaced closer, use a single continuous piece of root barrier.
2. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
3. Position top of root barrier just below the top of adjacent hardscape element but above finish grade of the soil so that is visible.
4. If there are concrete spoils or overpour that is impeding the root barrier from being installed directly adjacent to the hardscape element, the contractor is to remove the extra concrete in a manner that does not damage the integrity of the hardscape element.

5. Do not distort or bend root barrier during construction activities.
6. Do not install root barrier surrounding the root ball of tree.

B. Lawn Sod:

1. Cultivate all lawn areas to a depth of six inches (6"). If cultivation does not break lumps, pull a spike-toothed harrow over the area behind the tractor.
2. Give all lawn areas that are to be sodded a smooth finish to prevent pockets. Do not allow any abrupt changes of surface. Prior to installation of sod, roll the grade with a 200-pound water-ballast roller. Request that the lawn grade be inspected and approved by the Landscape Architect prior to sodding to determine its suitability for planting. Obtain such approval prior to commencing sodding operations.
3. Do not take heavy objects (except lawn rollers) over lawn areas after they have been prepared for planting.
4. Completely lay the sod within twelve hours (12 hrs.) of delivery. Do not leave sod on pallets in the hot sun longer than necessary.
5. Unroll sod carefully. Lay sod tight without any visible open joints, and without overlapping; stagger end joints twelve inches (12") minimum. Do not stretch or overlap sod pieces. Do not place sod in pieces smaller than twenty-four inches (24") in length by width of roll.
6. When new sod is to match existing turf, cut the edge of the existing turf in a series of straight lines that will accept new sod rolls in full width of the sod roll. Make the transition of grade between existing turf and new sod to be seamless with no change in elevation.
7. Immediately after laying sod, roll lawn areas with a 200-pound water-ballast roller.
8. Trim sod to conform to lawn shapes designated in Drawings.
9. On slopes of six inches (6") per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at a maximum of two feet (2') on center. Drive pegs flush with soil portion of sod.
10. Ensure that finished appearance is that of one continuous lawn.
11. Do not lay whole lawn before watering. When a conveniently large area has been sodded, water lightly to prevent drying. Continue to lay sod and to water until installation is complete.
12. All sod areas must be approved by Landscape Architect.
13. Water the complete lawn surface thoroughly. Moisten soil at least eight inches (8") deep. Repeat sprinkling at regular intervals to keep sod moist at all times until rooted. After sod is established, decrease frequency and increase amount of water per application as necessary.

C. Trees, Shrubs, and Groundcover:

1. Lay out individual tree and shrub locations and areas for multiple plantings. Stake the locations, outline the areas, and secure the Owner's Representative's acceptance before beginning the planting work. Make minor adjustments as requested.

2. Scarify root ball prior to planting. Plant in holes twice the diameter of the root ball and to a depth equal to the container's height. Place the shrub and/or groundcover so the top of the root ball is one inch (1") higher than the surrounding grade; place the tree so that the crown of the trunk is two inches (2") higher than the surrounding grade. Set container-grown stock in center of pit. In hot weather, pre-wet the pit. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Thoroughly compact lower half of backfill in plant pit. See staking or guying detail. Water after planting. Provide a berm or watering basin for each tree. Add Vitamin B-1, in the proper solution as recommended by the manufacturer, to the second watering of the basin.
3. Place fertilizer planting tablets in root zone and alongside each plant. Follow manufacturer's instructions for number of tablets to use for each container size.
4. See Drawings for additional information.
5. Grooming and Staking of Trees:
 - a. Prune, thin-out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Landscape Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees.
 - b. Paint cuts over one-half inch (½") in size with standard tree paint or compound, covering exposed, living tissue. Use paint that is waterproof, antiseptic, adhesive, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.
 - c. Stake or guy trees immediately after planting, as indicated on Drawings.
6. Grooming of Shrubs:
 - a. Prune, thin-out and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character and to accomplish their use in landscape design. The required plant size is its size after pruning.
 - b. Remove and replace excessively pruned or malformed new plants resulting from improper pruning.
7. Request review by the Landscape Architect after locating, but prior to planting all trees. Under the direction of the Landscape Architect, make slight adjustments to plant material location as necessary to reflect original intention of Drawings.

D. Weed Control

1. Apply pre-emergent weed control to all planting areas (except lawn) after completion of all planting and one complete watering. Follow manufacturer's directions. To prevent washing away of weed control, do not over-water after its application. Do not allow any weed control into lawn areas. Treat any existing noxious weeds, such as Johnson grass, with Roundup in successive treatments until all roots are destroyed, then remove all grass and roots. Notify Owner's Representative of time of installation for verification of application.

- E. Bark Mulch
 - 1. Apply mulch at the rate of three inches (3") deep to all planting areas, exclusive of lawn, after the planting and weed control are completed. Twelve inches (12") from planter edges, taper full depth of mulch to meet adjacent grades. Do not place mulch within three inches (3") of trunk or stems.
- F. Engineered Wood Fiber (EWF)
 - 1. Apply engineered wood fiber at the rate of six inches (6") deep after weed control is completed.

3.04 CLEANING

- A. During construction, keep the site free of rubbish and debris, and clean up the site promptly when notified to do so. Take care to prevent spillage on streets from hauling and immediately clean up any such spillage and/or debris deposited on streets due to the work of this Section.
- B. During all phases of the construction work, take all precautions to abate dust nuisance by clean-up, sweeping, sprinkling with water, or other means as necessary.

3.05 PROTECTION: MAINTENANCE

- A. The Landscape Maintenance Period will begin when all the Landscape Maintenance Period Requirements have been met (See Part 1 of these Specifications).
- B. Cleaning: Maintain cleanliness on paving areas and other public areas used by equipment and immediately remove all spillage. Remove from project site all rubbish and debris found thereon and all material and debris resulting from landscaping work, leaving the site in a safe and clean condition.
- C. Maintenance:
 - 1. Sprinkler Irrigation System:
 - a. Check system weekly for proper operation. Flush lateral lines out after removing last sprinkler head or two at each end of lateral. Adjust all heads as necessary for unimpeded coverage.
 - b. Set and program automatic controllers for seasonal water requirements. Provide the Owner's Representative with keys to the controllers and instructions on how to turn off system in case of emergency.
 - c. Repair all damages to sprinkler irrigation system as part of the contract work. Make repairs within one watering period or one week, whichever is the least amount of time.

2. Turf Areas:
 - a. Begin mowing turf when grass has reached a height of three inches (3") and cut to a height of one and one-half inches to two inches (1 ½" - 2"). Mow at least weekly after the first cut. Turf must be well-established and free of bare spots and weeds, to satisfaction of Landscape Architect, prior to final acceptance. Do not mow lawns when the soil is not able to support maintenance equipment. Repair wheel marks and ruts caused by the maintenance equipment at no additional cost to the Owner.
 - b. Pick up grass clippings and remove from the site and premises.
 - c. Trim edges at least twice monthly for neat appearance. Vacuum or blow clippings off walks.
 - d. Water the lawns at such frequency as weather conditions require to replenish soil moisture below the root zone. Normally, a total of one and one-half inches (1 ½") of water is needed weekly in hot weather.
 - e. Fertilize the lawn areas at the beginning of the Landscape Maintenance Period and at the completion of the Landscape Maintenance Period. Use a fertilizer with the following characteristics:
 - 1.) Slow release, Best 16-6-8, or approved equal, at the rate of 6.25 lbs per 1,000 square feet from March through October.
 - 2.) Calcium Nitrate (15-0-0) at the rate of 6.5 lbs per 1,000 square feet from November through February.
 - f. Broadcast fertilizer using a mechanical spreader; do not apply by hand-broadcasting. Sweep all fertilizer off hardscape into adjacent planters.
 - g. Weekly as needed and as directed, re-sod lawn areas with material that matches previously installed material. Use sod to repair any bare areas. Repair areas to receive sod as follows:
 - 1.) Mark out areas to receive new sod repair.
 - 2.) Cut straight lines that will accept sod the full width of the roll and a minimum of twenty-four inches (24") in length.
 - 3.) Transition the grade between existing turf and new sod seamlessly, with no change in elevation.
3. Trees and Shrubs:
 - a. Water enough that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
 - b. Construct and/or remove water basins around each plant, depending on the time of the year and as directed.
 - c. Do not prune unless directed by the Landscape Architect.
 - d. Re-stake and re-tie trees as needed and as directed by the Landscape Architect. Do not allow tops of tree stakes to protrude into head of tree.
 - e. Replace any dead, dying or vandalized plant material on a weekly basis throughout the Landscape Maintenance Period.

4. Insecticide and Herbicide Application:
 - a. If needed, control weeds with selective herbicides and sprays. In areas where crabgrass has infested the lawn, apply pre-emergent herbicides such as Dacthal by Amvac, Balan, or Betasan by Gowan for control prior to crabgrass germination. Control insect pests if necessary.
 - b. Use only a licensed Pest Control Operator to apply herbicides and sprays and to maintain a log for applications indicating material, timing, and rate.
5. Pre-scheduled On-site Meetings: Hold regularly-scheduled (monthly or bimonthly as determined by the Landscape Architect) on-site meetings with the Landscape Architect, Project Inspector and Owner's Representative. Dates and times will be jointly agreed upon.
6. Request, forty-eight hours (48 hrs.) in advance, on-site visits by the Landscape Architect to determine the end of the Landscape Maintenance Period.

END OF SECTION

SECTION 33 00 00

SITE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Domestic water piping system.
2. Fire protection piping systems.
3. Sewer piping system.
4. Other water and sewer items that may be specified or shown on the drawings.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 16 00, Site Concrete.
5. Section 33 00 00, Earthwork.

1.02 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.
- I. NFPA 13, 24 and 25, latest editions.
- J. California State Health and Safety Code Section 116875, Lead Free Public Water Systems.

K. California Plumbing Code, 2022 edition.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Provide sieve analysis from accredited testing lab on pipe bedding material. Analysis shall have a current date not older than project contract signing date.
- D. Substitution: Provide all data of proposed material being submitted as a substitution. Provide comparison with specified product data and identify all differences. Failure to provide comparison will be reason for rejection.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the drawings to be salvaged and re-used.
 - 1. Sun damaged or discolored PVC pipe will be rejected.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects or deficiencies discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction or incorrect grades will be the responsibility of the contractor.
- E. Per 2016 NFPA 13 provide Contractor's material and test certificate to the Owner, Architect, Project Inspector and Local Fire Authority.

1.05 FEES, PERMITS, AND UTILITY SERVICES

- A. Obtain and pay for permits and service charges required for installation of Work. Arrange for required inspections and secure written approvals from authorities having jurisdiction.
- B. Upon completion of work within right-of-way, provide copies of written final approval to the Architect.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.08 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.09 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.
- H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.10 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.11 RECORD DRAWINGS

- A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.
- B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.
- C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.
- D. Properly identify on as-builts and provide dimensions for all stubs for future connections. Provide concrete markers 6" dia. 12" deep, flush with finish grade at the ends of all stubbed pipes.

PART 2 – PRODUCTS

2.01 MATERIALS - GENERAL

- A. Provide each item listed herein or shown on drawings of quality noted or approved equal. All material shall be new, full weight, standard in all respects and in first-class condition. Insofar as possible, all materials used shall be of same brand or manufacture throughout for each class of material or equipment. Materials shall be of domestic manufacture and shall be tested within Continental United States.
- B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein.
- C. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.
- D. All materials in this section used for any public water system or domestic water for human consumption shall be lead free.
 - 1. For the purposes of this section, "lead free" means not more than 0.2 percent lead when used with respect to solder and flux and not more than 8 percent when used with respect to pipes and pipe fittings.
 - 2. All pipe, pipe or plumbing fitting or fixtures, solder, or flux shall be certified by an independent American National Standards Institute (ANSI) accredited third party, including, but not limited to, NSF International, as being in compliance with this section.

- E. All materials used for fire system piping shall be UL and FM approved.

2.02 VALVE BOXES

- A. Provide at each valve or cock in ground a Christy, Brooks, or equal to Christy G05CT, concrete valve box with cover marked for service, domestic water shall be marked "Water" and fire supply shall be marked "Fire". Furnish extension handles for each size square nut valve, and provide "fork" handle for each size of "wheel handle" valve as required. Do not locate valve boxes in walk, or covered passages, curbs, or curb & gutters, unless necessary. If valve location is within concrete or asphalt paved surface valve box shall be as detailed on plans for such condition. Provide valve box extensions as required to set bottom of valve box to bottom of piping in which valve is installed. Provide Owner with set of special wrenches and/or tools as required for operation of valves.

2.03 PIPES AND FITTINGS

- A. Sanitary Sewer: PVC sewer pipe and fittings with Ring-Tite joints, ASTM D3034 SDR35.
- B. Domestic water Lines 3 1/2" and smaller: Type K copper tubing, hard temper, with wrought copper fittings.
- C. Water lines 4" and larger: AWWA C-900 Class 150/DR18 with rubber gasket joints.
- D. Fire lines 4" and larger: AWWA C-900 Class 200/DR14 with rubber gasket joints.
- E. Solder: Lead Free. 95/5; 95% Tin / 5% Antimony.
- F. Ductile Iron Pipe; Class 350, Cement Lined
- G. Ductile Iron Pipe Fittings; AWWA C110, C153, Ebba Iron, Star Romac, Sigma, or approved equal.
- H. Mechanical Fitting Bolts; Bolts and nuts shall be carbon steel with a minimum 60,000 psi tensile strength conforming to ASTM A 307, Grade A. Bolts shall be standard ANSI B1.1 Class 2A course threads. Nuts shall conform to ASTM A 563 and be standard ANSI B1.1, Class 2A course thread. All bolts and nuts shall be zinc coated.
- I. Fasteners Anti-Rust Coatings; After assembly, coat all fasteners with an Asphaltic Bituminous coatings conforming to latest edition NFPA 24.
- J. Ductile Iron Pipe Wrap; 8 mil polyethylene pipe wrap conforming to ANSI/AWWA C105/A21.5 standards.
- K. Pipe Insulation; Pipe exposed to atmospheric conditions 1/2" thru 4" NPT; Johns Manville rigid fiberglass insulation, Micro Lok HP; Owens Corning Fiberglas SSL II; Conforming to ASTM C 612, Type 1A or type 1B.
- L. Aluminum field applied pipe insulation jacket; comply with ASTM B209, ASTM C1729, ASTM C1371 Manufacturers; Childers Metals; ITW Insulation Systems Aluminum Jacketing; or an approved equal.

1. Finish shall be flat mill finish
2. Factory Fabricated Fitting Covers; 45 and 90 degree elbows, tee's, valve covers, end caps, unions, shall be of the same thickness and finish of jacket.
3. The fittings shall be composed of 2-pieces
4. Adhesives; per the manufacturers requirements
5. Joint Sealant; shall be silicone, and shall be aluminum in color.

M. Sewer Forced Main; HDPE, DR 11, color gray with green stripe by JM Eagle or approved equal.

2.04 SANITARY SEWER MANHOLES

A. Shall be constructed as shown on plan details.

2.05 CLEANOUTS

A. Cleanouts of same diameter as pipe up to 8" in size shall be installed in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18" from building so as to provide sufficient space for rodding. No horizontal run over 100 feet shall be without cleanout whether shown on drawings or not.

B. All cleanout boxes shall be traffic rated with labeled lid, Christy G05CT or approved equal. Lid shall be vandal proof with stainless steel screws

2.06 UNIONS

A. Furnish and install one union at each threaded or soldered connection to equipment and 2 unions, one on each side of valves on pipes ½" to 3".

B. Locate unions so that piping can be easily disconnected for removal of equipment or valve. Provide type specified in following schedule:

Type of Pipe Union

Steel Pipe: 150 lb. Screwed malleable ground joint, brass, brass-to-iron seat, black or galvanized to match pipe.

Copper tubing: Brass ground joint with sweat connections.

PVC Sch 80 pipe: PVC union, FIPT X FIPT

2.07 VALVES

A. Provide valves as shown and other valves necessary to segregate branches or units. Furnish valves suitable for service intended. Valves shall be properly packed and lubricated. Valves shall be non-rising stem. Place unions adjacent to each threaded or sweat fitting valve. Install valves with bonnets vertical. All valves shall be lead free.

B. Valves ½" thru 2"; shall be made of bronze, full size of pipe and lead free. Nibco S-113-FL Series; American G-300 Series; Matco 511 FL Series; Apollo 102T-FL Series. Brass valves of brass parts within valves will not be accepted.

- C. Valves, 2 ½" thru 3" shall be class 150; Shall be made of bronze, full size of pipe; Jenkins Fig. 2310 J; Lunkenheimer Fig. 2153; Crane Fig. 437; Stockham Fig. B-128.
- D. Valves, Flanged; 4" thru 12" Ductile Iron Resilient Wedge Gate Valve; Nibco F 609 RW; American 2500 Series; Kennedy 8561; Mueller 2360 Series.

2.08 BACKFLOW PREVENTERS

Double Check Valve, Double Check Detector and Reduced Pressure Backflow Preventers

- A. Backflow preventers shall be as approved by the local agency and by the State of California's Department of Health Services most recent list of approved reduced pressure backflow preventers. All approved backflow preventers shall have ductile iron bodies.
 - 1. Provide Backflow preventer blankets with locking device. Weatherguard R-30 insulated or equal.
 - 2. Provide ball valve at all test ports with brass plug in valve.
 - 3. Provide a minimum of 2 valve tamper switches on fire prevention Backflows.

2.09 TAPPING SLEEVE

- A. Shall be used on pipe sizes 6" thru 12" and shall be made with stainless steel material including stainless steel bolts. Flanges shall be ductile iron or high carbon steel. Gaskets shall seal full circumference of pipe. Shall be manufactured for operating pressure of 200 psi, and shall pass test pressure of 300 psi. Romac SST series; Smithblair 662; Mueller H304; Ford "FAST" tapping sleeve.

2.10 SERVICE SADDLES

- A. Shall be used on pipe size 2" thru 4". Body shall be made from ductile iron with epoxy coating or bronze. Cascade Style CSC-1; A.Y. McDonald model 3891 AWWA/3892 FNPT; Smith-Blair #317; Ford S70, S71, S90, (style B).

2.11 TRACER WIRE

- A. No. 10 THW solid copper wire. Solder all joints

PART 3 - EXECUTION

3.01 DRAWINGS AND COORDINATION

- A. General arrangement and location of piping, etc., are shown on Drawings or herein specified. Install work in accord therewith, except for minor changes that may be necessary on account of other work or existing conditions. Before excavation, carefully examine other work that may conflict with this work. Install this work in harmony with other craft and at proper time to avoid delay of work.
- B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.
- C. In advance of construction, work out minor changes if conflicts occur with electrical or mechanical. Relocate services to suit actual conditions and work of other trades to avoid conflict therewith. Any

adjustments or additional fittings to make adjustments shall not be cause for additional costs to the owner.

- D. Execute any work or apparatus shown on drawings and not mentioned in specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor of furnishing same in place complete.
- E. Graded pipes shall take precedence. If conflict should occur while placing the domestic water and fire service piping, the contractor shall provide any and all fittings necessary to route the water lines over or under such conflicting pipes at no additional costs to the owner.

3.02 ACCESS

- A. Continuously check for clearance and accessibility of equipment or materials specified herein to be placed. No allowance of any kind shall be made for negligence on part of Contractor to foresee means of installing his equipment or materials into proper position.

3.03 EXCAVATING AND BACKFILLING

A. Excavation and Bedding:

1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or rock points. Trench width to be a minimum of 12" wider than outside diameter of pipe. Follow manufacturer's recommendations for use of each kind and type of pipe.
2. Bedding: Provide a bedding as noted on drawing details for the full length of the pipe. Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, which ever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.
3. If the trenches for the site utilities falls within areas to be lime treated, the piping shall be installed prior to any lime treatment operations, providing the elevation of the piping is below the treatment section.
 - a. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base, with minimum section equal to the lime treated section and compacted to 95%.

B. Laying of Pipe:

1. General: Inspect pipe prior to placing. Sun damaged pipe will be rejected. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe bell upgrade, true to line and grade.
 - a. Sewer pipe shall be laid in strict conformity to the prescribed line and grade, with grade bars set and each pipe length checked to the grade line. Three consecutive points on the same rate of slope shall be used at all times to detect any variation from a straight grade. In any case of discrepancy, work shall be stopped and the discrepancy immediately reported to the Owner's Representatives. In addition, when requested by the Owner's Representative, a string line shall be used in the bottom of the trench to insure a straight alignment of the sewer pipe between manholes. The maximum deviation from grade shall not be in excess of 1/4 inch. In returning the pipe to grade, no more than 1/4" depression shall result.
 - b. The Contractor shall expose the end of existing pipe to be extended, for verification of alignment and elevation, prior to trenching for any pipe which may be affected. All costs of

such excavation and backfill shall be included in the price paid for the various items of work.

- c. A temporary plug, mechanical type shall be installed on sewer pipe at the point of connection to existing facilities. If connecting to a public facility the plug shall conform to the requirements of the local jurisdiction. This plug shall remain in place until the completion of the balling and flushing operation.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap solution. Wedge joints tight. Bell of bell and spigot pipe to be pointed upgrade.

C. Backfilling:

1. General: Do not start backfill operations until required testing has been accomplished.
2. Compaction and Grading: Remainder of backfill shall be in accordance with Section 31 23 33 – TRENCHING AND BACKFILLING.
3. If trenching in area previously lime or cement treated backfill top of trench section, same depth as lime or cement treatment with Class 2 Aggregate Base compacted to 95% minimum relative compaction.

3.04 INSTALLATION OF WATER PIPING

- A. The contractor shall be responsible for determining the installed depth of all water piping, based on surfaces grades and minimum required depth of cover.
- B. Immediately cap or plug ends of, and opening in, pipe and fittings to exclude dirt until final connections made. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.
- C. General: Should existing conditions or other work prevent the running of pipes or the setting of equipment at the points indicated by drawings, changes as authorized by the Architect shall be made without additional cost to the Owner.
- D. All bolts used on mechanical fittings shall be thoroughly coated with an asphaltic bituminous coating conforming to 2016 NFPA 24, 10.4.1.1.
- E. All buried metal shall be incased with 8 mil polyethylene wrap so that no soil is in contact with metal. Ends of polyethylene wrap shall be taped to provide seal with pipe.
- F. Do not install water lines in same trench with non-metallic sewer lines unless bottom of water pipe at all points is at least 12" above top of sewer line and water line is placed on solid shelf excavated at one side of common trench with a minimum of 12 inch horizontal separation.
- G. Under no circumstance shall a fitting be located directly under a structural footing without prior approval from the Architect.
- H. In locations where existing domestic pipe is rerouted, the new pipe shall be assembled using restrained fittings at all joints including factory pipe joints. Tapped restrained blind flanges shall be temporarily installed at each end of the assembled pipes until testing and chlorination is completed and approved.

3.05 CLOSING IN OF UNINSPECTED WORK

- A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected, tested, and approved. Should work be enclosed or covered up before it has been approved, uncover work at own expense. After it has been inspected, tested and approved, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.06 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in new condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures and trim that are installed as part of this work. Leave systems and equipment in satisfactory new operating condition.
- B. Drain and flush piping to remove grease and foreign matter.
- C. Sewer piping shall be balled and flushed.
- D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.
- E. Flush fire service piping in the presence of the project inspector. Flushing shall be continued for a sufficient time as necessary to ensure all foreign material has been removed. Flow rate shall be equal to site fire flow requirements.

3.07 SEWER INTERNAL INSPECTIONS

- A. Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which resulted from the new installation, shall also be removed. Pipes shall be cleaned by the controlled balling and flushing method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt, and debris from entering the existing facility.

3.08 TEST OF PIPING

- A. Pressure Test piping at completion of roughing-in, in accord with following schedule, and show no loss in pressure or visible leaks after minimum duration or four (4) hours at test pressures indicated.
- B. Chlorination tests shall be performed after all fixtures and any required mechanical devices are installed and the entire system is complete and closed up.
- C. In cases where new domestic water piping is assembled for re-routing of existing domestic water pipe, the contractor shall perform the following testing prior to connecting the new water pipe to the existing system.
 - 1. The pipe shall be pressure tested and per the test schedule.
 - 2. The pipe shall be pressure tested down within the trench.
 - 3. The contractor shall dig a temporary ditch below the existing pipe to drain to a sump that is lower than the bottom of the trench and to the side of the trench. The sump shall be 30% larger than the total volume of water within the testing pipe assembly.
 - 4. After pressure testing and chlorination has taken place and accepted, the contractor shall drain

- the pipe into the sump and pump the sump out as it is filling.
5. The temporary test fittings at each end of the pipe assembly shall be removed and the final restrained couplings installed.
 6. The existing piping shall be cut and the water within the pipe shall drain below the pipe to the temporary sump. Pump the sump as it is being filled up. Take extreme caution not to contaminate the existing pipe with any contaminants within the trench.
 7. Before making the final coupling connections, the restrained couplings at each end of the new pipe shall be thoroughly swabbed inside the fitting with a solution of chlorine mixed with water at a rate of 1part chlorine to 4 parts potable water.
 8. After final connections are made, a visual inspection shall be made after fittings are wiped off. If after 1 hr, no noticeable drips are noted the pipe can be backfilled.
 9. The contractor shall flush all water piping affected by chlorination until it is within acceptable levels approved by certified testing lab.

TEST SCHEDULE

<u>System Tested</u>	<u>Test Pressure PSIG Test With</u>
Public water mains	Per local jurisdiction requirements.
Private domestic water piping and fire mains serving fire hydrants:	150 Lbs. Water 4 hrs.
Fire Protection Piping from PIV to fire riser:	200 Lbs. Water pressure, 4 hrs duration with no pressure loss.
Sanitary Sewer Piping:	Sewer system shall be tested for leakage per local jurisdiction requirements.

- D. Testing equipment, materials, and labor shall be furnished by contractor.

3.09 WATER SYSTEM STERILIZATION

- A. Public Water Mains: Shall be flushed and disinfected per the local jurisdiction requirements
- B. Clean and disinfect all site water systems connected to the domestic water systems in accordance with AWWA Standard C651 and as required by the local Building and Health Department Codes, and EPA.
 1. Clean and disinfect industrial water system in addition to the domestic water system.
 2. Disinfect existing piping systems as required to provide continuous disinfection upstream to existing valves. At Contractors option, valves may be provided to isolate the existing piping system from the new piping system.
- C. Domestic water sterilization shall be performed by a licensed “qualified applicator” as required by CAL-EPA Pesticide Enforcement Branch for disinfecting and sterilizing drinking water.

- D. Disinfecting Agent: Chlorine product that is a registered product with Cal-EPA for use in California potable water lines, such as Bacticide, CAL-EPA Registration No. 37982-20001.
- E. Contractor to provide a 1" service valve connected to the system at a point within 2'-0" of its junction with the water supply line. After sterilization is complete Contractor to provide cap at valve.
- F. Sterilization Procedure to be as follows:
 - 1. Flush pipe system by opening all outlets and letting water flow through the system until clear water flows from all outlets.
 - 2. Inject disinfecting agent to provide a minimum chlorine residual concentration of at least 50 parts per million (ppm) of free chlorine at each outlet.
 - 3. Provide sign at all outlets which reads "Water Sterilization in Progress – Do not operate". Remove signs at conclusion of test.
 - 4. Close all outlets and valves, including valve connecting to water supply line and 1" service valve. Retain treated water in pipe for a minimum of twenty-four hours. Should chlorine residual at pipe extremities be less than 50 PPM at this time, pipe shall be re-chlorinated. As an option, the water systems may be filled with a water-chlorine solution containing a minimum of 200 PPM of chlorine and allowed to stand for three hours.
 - 5. After chlorination, flush lines of chlorinated water and refill from domestic supply. Continue flushing until residual chlorine is less than or equal to 0.2 ppm, or a residual the same as that of the test water.
- G. Chemical and bacteriological tests shall be conducted by a state-certified laboratory and approved by the local authorities having jurisdiction.
- H. Submit written report to Health Department as required by State Regulations. Provide a copy of report to Architect prior to completion of project.
- I. The costs of sterilization and laboratory testing shall be paid for by the contractor.

3.10 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

END OF SECTION

SECTION 33 40 00

SITE DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Storm Drain piping, fittings, structures.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 16 00, Site Concrete.
5. Section 33 00 00, Earthwork.

1.02 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.
- I. NFPA 13, 24 and 25, latest editions.
- J. California State Health and Safety Code Section 116875, Lead Free Public Water Systems.

K. California Plumbing Code, latest edition.

1.03 SUBMITTALS

A. Refer to Section 01 33 00.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

C. Provide sieve analysis from accredited testing lab on pipe bedding material. Analysis shall have a current date not older than project contract signing date.

D. Substitution: Provide all data of proposed material being submitted as a substitution. Provide comparison with specified product data and identify all differences. Failure to provide comparison will be reason for rejection.

1.04 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the drawings to be salvaged and re-used.

1. Sun damaged or discolored PVC pipe will be rejected.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects or deficiencies discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction or incorrect grades will be the responsibility of the contractor.

E. Per 2016 NFPA 13 provide Contractor's material and test certificate to the Owner, Architect, Project Inspector and Local Fire Authority.

1.05 FEES, PERMITS, AND UTILITY SERVICES

A. Obtain and pay for permits and service charges required for installation of Work. Arrange for required inspections and secure written approvals from authorities having jurisdiction.

B. Upon completion of work within right-of-way, provide copies of written final approval to the Architect.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.08 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.09 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during

entire progress of work, regardless of cause, source, or nature of water.

- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.
- H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.10 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.11 RECORD DRAWINGS

- A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.
- B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.
- C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.
- D. Properly identify on as-builts and provide dimensions for all stubs for future connections. Provide concrete markers 6" dia. 12" deep, flush with finish grade at the ends of all stubbed pipes.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipe: Use one of the following, unless noted on the Drawings otherwise.
 - 1. Polyvinyl Chloride Pipe (PVC): SDR35 conforming to ASTM D3034 with elastomeric joints conforming to ASTM D3212. Sun damaged pipe will be rejected.
 - 2. High density polyethylene pipe (HDPE): The pipe shall be corrugated exterior/smooth interior pipe and water tight per ASTM D3212 with dual wall water tight gasket fittings.
- B. Perforated Pipe (for subdrains): Shall be ADS N12 pipe, 3 hole, ASTM F 405, AASHTO M 252; PVC ASTM D3034 SDR-35 storm drain pipe
- C. Manhole: Shall be as shown on the drawing details.
- D. Drop Inlet: Shall be as shown on the drawing details.

- E. Curb Inlet: Shall be as shown on the drawing details.
- F. Mortar: For pipe connections to concrete drainage structures, conform to ASTM C270 type N mortar. Place within one half hour after adding water.
- G. Crushed Rock: Imported washed crushed rock. Minimum 100% passing 3/4 inch sieve.
- H. Trench drain: Polycast, Polydrain or equal and as shown on drawings.
- I. Area Drains: Shall be as shown on the drawing details.
- J. Floor Drains: Shall be as shown on the drawing details.
- K. Clean-outs: Shall be as shown on the drawing details.
- L. Planter drains: Shall be as detailed on the drawing details.
- M. Filter Fabric: Mirafi 140N.

PART 3 - EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 INSTALLATION

- A. General: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.
- B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.
- C. Excavation and Bedding:
 - 1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or

rock points. Trench width in accordance with pipe manufacturer's recommendations and as per the drawings. Follow manufacturer's recommendations for use of each kind and type of pipe.

2. Bedding: Provide bedding as detailed on plans for the full length of the pipe. Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, whichever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.
3. If the trenches for the site drainage fall within areas to be lime treated, the piping shall be installed prior to any lime treatment operations.
 - a. If additional piping is added to previously lime treated areas, the contractor shall backfill the trench with class 2 aggregate base and compact to 95%.

D. Laying of Pipe:

1. General: Inspect pipe prior to placing. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe upgrade, true to line and grade.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap solution or as recommended by manufacture. Wedge joints tight. Bell of bell and spigot pipe to be pointed upgrade.
3. Pipe shall be bedded uniformly throughout its length.
4. Pipe elevation shall be within 0.02 feet of design elevation as shown on plans.
5. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the governing agency.

E. Backfilling:

1. General: Do not start backfill operations until required testing has been accomplished.
2. Trenches and Excavations: Backfill with material as detailed on plans, filling both sides of the pipe at the same time, carefully tamping to hold pipe in place without movement. Refer to Section 31 23 33 – TRENCHING AND BACKFILLING for fill above this layer.

F. Grouting of Pipes: Grout pipes smooth and water tight at drop inlet, manholes, and curb inlets. Grout back side of hood at curb inlets all grouting shall be smooth and consistent.

G. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the local agency.

H. Cutting and Patching: Remove and replace existing surface features per applicable specification section (i.e. asphaltic concrete or concrete paving) where pipe is installed in areas of existing improvements.

3.03 TOLERANCES

A. Storm Drain structure grates

1. In landscape and lawn areas +/- 0.05'.
2. In sidewalk and asphalt pavement +/- 0.025'.
3. In curb and gutter application +/- 0.0125'.

B. Cleanout Boxes and Lids

1. In landscape areas; 0.10 higher than surrounding finish grade, $+0.05'$.
2. In sidewalks and asphalt pavement; Flush with surrounding finish grade, $+0.025'$.

3.03 DEWATERING

- A. Contractor to provide trench dewatering as necessary, no matter what the source is, at no additional cost to the owner.
- B. If the previously excavated material from trenching is too wet to achieve trench backfill compaction the contractor shall make a reasonable effort to aerate and dry the material per section 31 00 00, 3.08, B

3.04 FLUSHING

- A. The Contractor shall thoroughly ball and flush the storm drain system to remove all dirt and debris. Discharge water to an approved location.

3.05 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean the dirt, rocks, and debris from all storm drain inlets, structures, and connecting pipes.

END OF SECTION