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## **SECTION 02 41 14 - SITE UTILITY DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Specifications for Demolition and removal of site utilities, as indicated.
- B. Extent of demolition work shall be as follows:
  - 1. All existing underground pipes within the limits of the project will be removed. Abandoned pipes shall be abandoned as approved by the Engineer. Abandoned portion at the limits shall be capped with concrete and/or pipe fittings as determined by the Engineer.
- C. Restoration of existing structures and facilities to remain in place which are damaged by demolition and removal operations.

#### **1.02 SUBMITTALS**

- A. Demolition Plan: Refer to plans for limits of demolition

#### **1.03 RELATED SECTIONS**

- A. Section 31 20 00 – Earthmoving
- B. Section 31 23 19 - De-watering
- C. Section 312333 - Trenching and Backfilling.
- D. Section 312513 - Erosion Controls.

#### **1.04 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI A10.6 Safety Requirements for Demolition Operations
- B. California Code of Regulations (CCR):
  - 1. CCR Title 8, Chapter 4, Subchapter 4 – Construction Safety Orders
  - 2. CCR Title 24, Part 2, California Building Code, Chapter 33, Section 3303, Protection of Pedestrians during Construction or Demolition

#### **1.05 PERMITS**

- A. Obtain all special permits and licenses and give all notices required for performance and completion of the demolition and removal work, hauling, and disposal of debris.

#### **1.06 WASTE DISPOSAL AND RECYCLING**

- A. The Contractor shall implement recycling and waste management policies for all waste materials removed as a result of construction and demolition activities.

#### **1.07 SITE CONDITIONS**

- A. Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other measures as necessary to protect the students, workers, public and adjoining property from damage from demolition work, all in accordance with applicable codes and regulations.
- B. Open depressions and excavations occurring as part of this work shall be barricaded and posted with warning lights when accessible through adjacent property or through public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
- C. Protect utilities, pavements, and facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by demolition operations.
- D. Protection of Utilities: Protect active sewer, water, gas, electric, and other utilities; and drainage and irrigation lines indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work.
- E. Maintain existing utilities and protect from damage as necessary to satisfy the requirements of the District and jurisdictional utility companies and the related codes and regulations.
- F. Make arrangements with affected utility companies and District to provide the information and services necessary to coordinate and complete the Work.
- G. Do not disconnect or shut down any part of the existing utilities and services, except by permission of the District and authorities having jurisdiction. Submit a schedule of estimated shut-down times to the District in order to obtain such permission, and notify all interested parties, neighbors, utilities, and municipal and county authorities, as required.
- H. Utilities to be removed shall not be removed until shut-down time can be kept to a minimum. Do not remove an existing utility line or service until the replacement line, crossover, or capping is ready to be performed.
- I. Notify the Engineer and utility owners 72 hours before performing any excavation work. Notify affected utilities by calling Underground Service Alert (USA) at 1-800-227-2600. Contact utility owners not covered by USA, by calling the affected utility owners directly.
- J. Protect active underground utilities from damage. If underground utilities are damaged in any way, notify the Engineer and affected utilities immediately for corrective action.
- K. Noise and Dust Abatement: Comply with requirements specified in Section 015000 - Temporary Facilities and Controls. In addition, provide continuous noise and dust abatement

as required to prevent disturbance and nuisance to the public and workers and to the occupants of adjacent premises and surrounding areas. Dampen or cover areas affected by demolition operations as necessary to prevent dust nuisance.

- L. The Contract Drawings and related documents may not represent all surface conditions at the site and adjoining areas. The known surface conditions are as indicated, and shall be compared with actual conditions before commencement of work.
- M. Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other such surface fixtures.
- N. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the work until written instructions are received from the Engineer.
- O. Thicknesses of existing pavements are from previous construction documents, and do not imply the actual depth or thickness of the total pavement or base material, where it occurs. Remove pavement of whatever thickness as required.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS, EQUIPMENT, AND FACILITIES**

- A. Furnish all materials, tools, equipment, facilities, and services as required for providing the necessary protection, demolition, and removal work.
- B. Provide backup equipment as necessary for the replacement and for unanticipated emergencies.

**END OF SECTION**

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## SECTION 03 05 16 - UNDERSLAB VAPOR RETARDER

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Sheet vapor barrier under concrete slabs on grade.

#### 1.02 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Preparation of concrete floor substrates to receive floor finishes.

#### 1.04 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
  - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Underslab Vapor Barrier:
  - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum as tested in accordance with mandatory conditioning tests per ASTM E1745
  - 2. Strength: Complying with ASTM E1745 Class A.
  - 3. Thickness: 15 mils.
  - 4. Basis of Design:
    - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): [www.stegoindustries.com/#sle](http://www.stegoindustries.com/#sle).
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams, perimeter edges, and penetrations in vapor barrier.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

- B. Ensure that subgrade is level and compacted in accordance with requirements of the Geotechnical report and approved by Architect or Geotechnical Engineer.

**3.02 INSTALLATION**

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Repair damaged vapor retarder before covering with other materials.

**END OF SECTION 03 05 16**

## **SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Structural Concrete; 2016.
- C. PS 1 - Structural Plywood; 2009.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data on void form materials and installation requirements.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
- C. Designer's Qualification Statement.
- D. Design Data: As required by authorities having jurisdiction.

#### **1.05 QUALITY ASSURANCE**

- A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

#### **1.06 MOCK-UP**

- A. Construct a mock-up of formwork for Utility Building exterior walls, 86' feet long with height as indicated on drawings.
  - 1. Include reinforcement, ties, and accessories specified in Section 03 20 00.
  - 2. Provide concrete in accordance with provisions of Section 03 30 00.
  - 3. Cure concrete in accordance with provisions of Section 03 30 00.
- B. Mock-up may remain as part of the Work.

## **PART 2 PRODUCTS**

### **2.01 FORMWORK - GENERAL**

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Chamfer outside corners of beams, joists, columns, and walls.
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

### **2.02 WOOD FORM MATERIALS**

- A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

### **2.03 FORMWORK ACCESSORIES**

- A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer. Match size and spacing to existing adjacent storage structure, as indicated on the drawings.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
- C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.
- D. Filler Strips for Chamfered Corners: Rigid plastic type. Size to match chamfer at existing adjacent storage structure.
- E. Waterstops: Rubber, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

### **3.02 ERECTION - FORMWORK**

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Coordinate this section with other sections of work that require attachment of components to formwork.

### **3.03 APPLICATION - FORM RELEASE AGENT**

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

### **3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS**

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

### **3.05 FORM CLEANING**

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.

### **3.06 FORMWORK TOLERANCES**

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

### **3.07 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Division 01.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- C. Reuse forms only if surfaces are cleaned, damaged areas are repaired, and projecting nails removed.
  - 1. Do not patch formwork.
  - 2. Apply new form release agent on re-used forms.

### **3.08 FORM REMOVAL**

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

**END OF SECTION 03 10 00**

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## **SECTION 03 20 00 - CONCRETE REINFORCING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Structural Concrete; 2016.
- B. ACI SP-66 - ACI Detailing Manual; 2004.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- D. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- G. CRSI (DA4) - Manual of Standard Practice; 2009.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
  - 1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.
- B. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301.

## **PART 2 PRODUCTS**

### **2.01 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
  - 1. Plain billet-steel bars.
  - 2. Unfinished.
- B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
  - 1. Unfinished.
- C. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.
- D. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
  - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

### **2.02 FABRICATION**

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

## **PART 3 EXECUTION**

### **3.01 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Comply with applicable code for concrete cover over reinforcement.

### **3.02 FIELD QUALITY CONTROL**

- A. An independent testing agency, as specified in Division 01, will inspect installed reinforcement for compliance with contract documents before concrete placement.

**END OF SECTION 03 20 00**

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

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Floors and slabs on grade.
- B. Concrete shear walls and foundation walls.
- C. Joint devices associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads, equipment pits, thrust blocks, and manholes.
- E. Concrete curing.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

#### **1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Structural Concrete; 2016.
- B. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ACI 305R - Guide to Hot Weather Concreting; 2010.
- E. ACI 306R - Guide to Cold Weather Concreting; 2016.
- F. ACI 308R - Guide to External Curing of Concrete; 2016.
- G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
- I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2017a.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.
- K. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.
- L. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

- M. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.
- N. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.
- O. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- P. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011 (Reapproved 2017).
- Q. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

#### **1.04 SUBMITTALS**

- A. See Division 01, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
  - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.
- G. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

### **PART 2 PRODUCTS**

#### **2.01 FORMWORK**

- A. Comply with requirements of Section 03 10 00.

## **2.02 REINFORCEMENT MATERIALS**

- A. Comply with requirements of Section 03 20 00.

## **2.03 CONCRETE MATERIALS**

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

## **2.04 ADMIXTURES**

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Waterproofing Admixture System: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties; includes manufacturer-provided field services and performance warranty.

## **2.05 ACCESSORY MATERIALS**

- A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
  - 1. Installation: Comply with ASTM E1643.
  - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
- B. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.

## **2.06 BONDING AND JOINTING PRODUCTS**

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
  - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
- D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
- E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

## **2.07 CURING MATERIALS**

- A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
- C. Moisture-Retaining Sheet: ASTM C171.
- D. Water: Potable, not detrimental to concrete.

## **2.08 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

- A. Verify that forms are clean and free of rust before applying release agent.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
  - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

### **3.03 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### 3.04 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

### 3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
  - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### 3.06 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
  - 1. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

### 3.07 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
- D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
3. Final Curing: Begin after initial curing but before surface is dry.

### **3.08 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Division 01.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

### **3.09 DEFECTIVE CONCRETE**

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

### **3.10 PROTECTION**

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

**END OF SECTION 03 30 00**

## SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Grouting under base plates.

#### 1.02 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.
- F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014 (Editorial 2017).
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
- I. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2014.
- J. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.
- K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).
- L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).
- M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- N. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2016.
- O. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series; 2017a.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2017.

- R. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2014, with Errata (2015).
- S. SSPC-SP 3 - Power Tool Cleaning; 1982, with Editorial Revision (2004).

### 1.03 SUBMITTALS

- A. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
  - 2. Connections.
- B. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- C. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.
- D. Materials Test Reports: Submit independent test results or engineered performance analysis of structural thermal-break pad performance in bearing or slip-critical connections where shear and moment loads are applied.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

### 1.04 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- C. Erector: Company specializing in performing the work of this section with minimum 10 years of documented experience.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- E. Steel Bars: ASTM A108.
- F. Steel Plate: ASTM A514/A514M.
- G. Pipe: ASTM A53/A53M, Grade B, Finish black.

- H. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.
- I. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- J. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.
- K. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- L. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
  - 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
  - 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
- M. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- N. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

## **2.02 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Fabricate connections for bolt, nut, and washer connectors.

## **2.03 FINISH**

- A. Prepare structural component surfaces in accordance with SSPC-SP 3.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

## **2.04 SOURCE QUALITY CONTROL**

- A. Provide shop testing and analysis of structural steel.
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least \_\_\_\_ percent of bolts at each connection.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

### **3.02 ERECTION**

- A. Erect structural steel in compliance with AISC 303.

- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.
- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

### **3.03 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Division 01.

**END OF SECTION 05 12 00**

## **SECTION 05 50 00 - METAL FABRICATIONS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Shop fabricated steel and aluminum items.

#### **1.04 SUBMITTALS**

- A. CALGreen Submittals: Provide the following:
  - 1. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
- 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.

#### **1.05 QUALITY ASSURANCE**

- A. Design Criteria
  - 1. Work shall be designed to support normally imposed loads and conform to AISC requirements.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction, including CALGreen.

- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction, including CALGreen.

## **2.02 MATERIALS - ALUMINUM**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

## **2.03 FABRICATION**

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

## **2.04 FABRICATED ITEMS**

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of countertops, and similar non-structural items; prime paint finish.
- D. Door Frames for Overhead Door Openings: Channel sections; prime paint finish.
- E. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

## **2.05 FINISHES - STEEL**

- A. Prime paint steel items.
  - 1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and all exterior items.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

## **2.06 FINISHES - ALUMINUM**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick; light bronze.
- C. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.
  - 1. Manufacturers: Valspar; Fluoropon: [www.valsparcoilextrusion.com/#sle](http://www.valsparcoilextrusion.com/#sle).
- D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

## **PART 3 EXECUTION**

### **3.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

**END OF SECTION**

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## **SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Conventional ballasted system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Deck sheathing.
- E. Cover boards.
- F. Flashings.

#### **1.02 RELATED REQUIREMENTS**

- A. None

#### **1.03 ADMINISTRATIVE REQUIREMENTS**

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

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, and fasteners.
- B. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- E. Specimen Warranty: For approval.

#### **1.05 QUALITY ASSURANCE**

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

#### **1.06 WARRANTY**

- A. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  - 1. Warranty Term: 30 years.

2. For repair and replacement include costs of both material and labor in warranty.
3. Exceptions are not Permitted:

## **PART 2 PRODUCTS**

### **2.01 PERFORMANCE**

- A. Fire Rating: Roofing assembly shall have a U.L.Class A Fire Rating..
- B. Product shall have a minimum initial reflectance of at least 0.70 when tested in accordance with CRRC-1, ASTM E903 and emissivity at least 0.75 when tested in accordance with CRRC-1, ASTM E408..

### **2.02 ROOFING**

- A. Thermoplastic Membrane Roofing: One-ply membrane loose-laid over insulation and vapor retarder, adhered or ballasted.
- B. Acceptable Manufacturer:
  1. For slopes less than 4:12: The Garland Company
- C. Flexible Flashing Material: Same material as membrane.

### **2.03 DECK SHEATHING**

- A. Deck Sheathing: Perlite board, ASTM C728, 3/4 inch thick.

### **2.04 COVER BOARDS**

- A. Cover Board: Cement board complying with ASTM C1325.

### **2.05 INSULATION**

- A. Perlite Board Insulation: Expanded perlite mineral aggregate, complying with ASTM C728.
- B. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with natural skin surface, drainage channels on one face.
  1. Tapered Board: Slope as indicated; minimum thickness 1/2 in; fabricate of fewest layers possible.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION - GENERAL**

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

**END OF SECTION**

## SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, exterior penetrations.

#### 1.02 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
  - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
  - 2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
  - 3. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

#### 1.03 QUALITY ASSURANCE

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

### PART 2 PRODUCTS

#### 2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 20 gage base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 20 gage base metal, shop pre-coated with PVDF coating.
- C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.
- D. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.

#### 2.02 FLASHING UNDERLAYMENT

- A. Sheet Membrane Underlayment at Flashings: Self-adhered, cold-applied composite rubberized asphalt sheet membrane consisting of rubberized asphalt bonded to a cross-laminated high-density polyethylene film.

1. Minimum 40-mil thick, high temperature self-adhering, polymer-modified, bituminous sheet membrane, complying with ASTM D1970. Ensure named product is compatible with fluid-applied membrane air barrier material for a complete weathertight system.

### **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects. Form pieces in longest possible lengths.
- B. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- C. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- D. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- E. Gutters and Downspouts: Form gutters and downspouts not furnished as part of the Metal Panel Roof system to profiles as indicated.

### **2.04 EXTERIOR PENETRATION FLASHING PANELS**

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.02 UNDERLAYMENT**

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation

### **3.03 INSTALLATION**

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- B. Seal metal joints watertight.

**END OF SECTION**

## **SECTION 07 84 00 - FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Firestopping systems for joints and penetrations in fire resistance rated and smoke resistant assemblies.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Firestopping Manufacturers:
  - 1. 3M Fire Protection Products: [www.3m.com/firestop/#sle](http://www.3m.com/firestop/#sle).
  - 2. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 3. Specified Technologies Inc: [www.stifirestop.com/#sle](http://www.stifirestop.com/#sle).

#### **2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- B. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

#### **2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS**

- A. Penetrations By:
  - 1. Multiple Penetrations in Large Openings:
  - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
  - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
  - 4. Electrical Cables Not In Conduit:
  - 5. Cable Trays with Electrical Cables:
  - 6. Insulated Pipes:
  - 7. HVAC Ducts, Insulated:

#### **2.05 FIRESTOPPING SYSTEMS**

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

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

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

#### **3.02 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Inspection agency employed and paid by District, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

**END OF SECTION**

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Field quality control

#### 1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. A. Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- C. Division 32: Joints in pedestrian and vehicular pavement, curbs and gutters.

#### 1.03 SUBMITTALS

- A. CALGreen Submittals: Provide product data to demonstrate that adhesives, sealants, and caulks used on the project meet the requirements of the following standards:
  - 1. TABLE 5.504.4.1 - ADHESIVE VOC LIMIT; TABLE 5.504.4.2 - SEALANT VOC LIMIT as listed in Section 01 81 13 - Sustainable Design Requirements.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

### PART 2 PRODUCTS

#### 2.01 SUSTAINABLE MATERIAL REQUIREMENTS, GENERAL

- A. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products as specified in subsection 2, below.
- B. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other

requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

- C. Refer to Section 01 81 13 - Sustainable Design Requirements for requirements for low-emitting materials.

## 2.02 JOINT SEALANT APPLICATIONS

### A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
  - a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Openings below ledge angles in masonry.
  - e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
  - a. Joints between door, window, and other frames and adjacent construction.
  - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
  - c. Other joints indicated below.
3. Do not seal the following types of joints.
  - a. Intentional weepholes in masonry.
  - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
  - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
  - d. Joints where installation of sealant is specified in another section.
  - e. Joints between suspended panel ceilings/grid and walls.

## 2.03 EXTERIOR JOINT SEALANTS

- A. Exterior Silicone Weatherproofing and Control Joint Sealant: ASTM C920, also ASTM C1193 and tested under ASTM C719; Type S, Grade NS, Class 100/50, Use NT, M, G, A, and O; single component, low-modulus, non-sag sealant, use at exterior joints in vertical surfaces and non-traffic horizontal surfaces.
- B. Reglets and Flashings Polyurethane Sealant: ASTM C920, polyurethane-based sealant; Type S, Grade NS, Class 100/50, and Use T, NT, G, and M; single component elastomeric.
- C. Concrete Walkway Joint Sealant: ASTM C920, Type M and A, Grade P, Class 25, Use T, M, and O; multi-component, pourable urethane sealant.

## 2.04 INTERIOR JOINT SEALANTS

- A. Interior Weatherproofing and Control Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O; single component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected; use in interior surfaces.
- B. Wood Panel Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, O; single-component urethane, color to be selected.
- C. Interior Latex Joint Sealant: Provide product complying with ASTM C834, Type S, Use O, Grade NS; use at interior joints in vertical surfaces and non-traffic horizontal surfaces.
- D. Mildew Resistant Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25; Use NT, G, A, and O; use on non-porous interior surfaces under high humidity and temperature extremes. For use in bathrooms, spas, and similar applications where joints need protection against fungi and bacteria.
- E. Interior Food Contact Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, and O; USDA compliant.
  - 1. Joints in kitchen countertops and work surfaces.
  - 2. Joints between food service equipment and surrounding construction.
  - 3. Other interior joints where incidental food contact may occur.
- F. Acoustical Sealant for Exposed and Concealed Joints: Non-sag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90; use for drywall or plaster wall systems, bedding electrical boxes and other wall outlets.

## 2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
- B. Outlet Box Sealant: Resilient sealer pads; use to seal back and sides of all junction boxes recessed in acoustically-rated partitions.
- C. Compressible Tape: 1/4-inch-thick, double-sided, closed-cell foam tape; use to seal interior partitions to window mullions.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.

**3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

**3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

**3.04 FIELD QUALITY CONTROL**

- A. Perform field quality control inspection/testing.
- B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- C. Repair destructive test location damage immediately after evaluation and recording of results.

**END OF SECTION**

## SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

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

#### 1.02 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- E. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- G. UL (DIR) - Online Certifications Directory; current listings at [database.ul.com](http://database.ul.com).

#### 1.03 SUBMITTALS

- A. CALGreen Submittals: Provide the following:
  - 1. Product Data for CALGreen 5.504.4.1 – Finish Material Pollutant Control; Adhesives, Sealants, and Caulks: For adhesives, sealants, and caulks, including printed statement of VOC content and chemical components.
  - 2. Product Data for CALGreen 5.504.4.3 – Finish Material Pollutant Control; Architectural paints and coatings, including printed statement of VOC content and chemical components.
  - 3. Refer to Section 01 81 13 - Sustainable Design Requirements: Requirements for low-emitting materials.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

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

### **2.02 HOLLOW METAL DOORS**

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 3 - Extra Heavy-duty.
    - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
    - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
  - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
    - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
  - 3. Door Thickness: 1-3/4 inches, nominal.
  - 4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
- C. Interior Doors, Non-Fire-Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
    - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
  - 2. Door Thickness: 1-3/4 inches, nominal.
- D. Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.

- d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
- e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches, nominal.
- E. Sound-Rated Interior Doors:
  1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
    - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
  2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 39, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
  3. Outdoor-Indoor Transmission Class (OITC) Rating of Door and Frame Assembly: OITC of 35, minimum, calculated in accordance with ASTM E1332, and tested in accordance with ASTM E90.
  4. Sound Transmission Loss (TL) of Door and Frame Assembly: TL of 40 dB at 500 to 1250 Hz, minimum, in accordance with ASTM E90 testing.
  5. Door Core Material: Manufacturer's standard construction as required to meet acoustic requirements indicated.
  6. Door Thickness: As required to meet acoustic requirements indicated.
  7. Sound Seals: Integral, in door and/or frame.
  8. Opening Force of Sound-Rated Doors, Non-Fire-Rated: 5 pounds, maximum, in compliance with ADA Standards.

### **2.03 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
  1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
  2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
- D. Interior Door Frames, Non-Fire Rated: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
  1. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
- E. Door Frames, Fire-Rated: Knock-down type
  1. Fire Rating: Same as door, labeled.

2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
  3. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
- F. Sound-Rated Door Frames: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
1. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
- G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- H. Mullions for Pairs of Doors: Removable, locking design, with profile similar to jambs.
- I. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- J. Transom Bars: Fixed, of profile same as jamb and head.
- K. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

## **2.04 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
1. Fire-Rated Frames: Comply with fire rating requirements indicated.

## **2.05 ACCESSORIES**

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components; factory-installed.
- B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
1. Frame Material: 18 gage, 0.0478 inch, galvanized steel, with finish to match door.
  2. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction. Provide fire rated glazing at labeled doors. Removable Stops: Formed sheet steel, square profile.
- C. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices. Astragal Type: Overlapping, T-shaped, with coordinator for proper door closing sequence, and with automatic locking, cutouts for other door hardware, and sealing gasket.
- D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

- B. Install fire rated units in accordance with NFPA 80.

### **3.02 ADJUSTING**

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.
- C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

**END OF SECTION**

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## **SECTION 08 33 23 - OVERHEAD COILING DOORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Overhead coiling doors, operating hardware; exterior, electrically operated.
- B. Wiring from electric circuit disconnect to operator to control station.

#### **1.02 SUBMITTALS**

- A. Product Data: Provide general construction, electrical equipment, and component connections and details.
- B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

#### **1.03 WARRANTY**

- A. Provide five-year manufacturer limited warranty for three-ply multifilament polyester fabric curtain.
- B. Provide lifetime manufacturer limited warranty for counterweights and tension springs.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Overhead Coiling Doors:
  - 1. Cornell Iron Works, Inc; [www.cornelliron.com/#sle](http://www.cornelliron.com/#sle).
  - 2. Raynor Garage Doors; DuraCoil, [www.raynor.com/#sle](http://www.raynor.com/#sle).
  - 3. The Cookson Company; [www.cooksondoor.com/#sle](http://www.cooksondoor.com/#sle).

#### **2.02 COILING DOORS**

- A. Exterior Coiling Doors: Steel slat curtain.
  - 1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
  - 2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1.
  - 3. Nominal Slat Size: 2 inches wide by required length.
  - 4. Finish: Galvanized and factory primed.
  - 5. Guide, Angles: Galvanized steel.
  - 6. Hood Enclosure: Manufacturer's standard; primed steel.
  - 7. Electric operation.
  - 8. Mounting: Within framed opening.

### 2.03 MATERIALS AND COMPONENTS

- A. Metal Curtain Construction: Hinged slats.
  - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
  - 2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
  - 3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
  - 4. Steel Slats: Minimum thickness, (TBD) gage, ASTM A653/A653M galvanized steel sheet.
    - a. Galvanizing: Minimum G90 coating.
- C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
  - 1. Hot-dip galvanized in compliance with ASTM A123/A123M.
  - 2. Prime paint.
- D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
  - 1. Minimum thickness; (TBD) gage.
  - 2. Prime paint.
- E. Lock Hardware:
  - 1. For motor operated units, additional lock or latching mechanisms are not required.
- F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

### 2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
  - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
  - 1. Mounting: Side mounted.
  - 2. Motor Enclosure:
    - a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
  - 3. Opening Speed: 12 inches per second.
    - a. Provide independently controlled opening and closing speeds.
  - 4. Brake: Manufacturer's standard type, activated by motor controller.
  - 5. Manual override in case of power failure.
- C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
  - 1. 24 volt circuit.
  - 2. Surface mounted, at interior door jamb.

3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
  - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Securely and rigidly brace components suspended from structure. Secure guides to structural members only. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- C. Coordinate installation of electrical service with Division 26.
- D. Complete and test wiring from fire alarm system.
- E. Install enclosure and perimeter trim.

#### **3.02 ADJUSTING**

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

**END OF SECTION**

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## **SECTION 08 71 00 - DOOR HARDWARE**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Door hardware that is 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. Door Hardware, including electric hardware.
- C. Storefront and Entrance door hardware.
- D. Digital keypad access control devices.
- E. Power supplies for electric hardware.
- F. Low-energy door operators plus sensors and actuators.
- G. Thresholds, gasketing and weather-stripping.
- H. Door silencers or mutes.

#### **1.02 RELATED SECTIONS**

- A. Section 08 11 13 – Hollow Metal Doors and Frames.
- B. Section 08 14 16 – Flush Wood Doors.
- C. Section 08 43 13 – Aluminum-Framed Storefronts
- D. Section 08 43 14 – Aluminum-Framed Folding Panel Systems
- E. Division 28: Fire/Life-Safety Systems & Security Access Systems.

#### **1.03 SUBMITTALS**

- A. 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.
- B. Submit 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. Cover Sheet
  - 2. Job Index information
    - 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").
    - 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.

- C. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.
- D. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

#### **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.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

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

#### **1.07 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.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

A.		Mfr.	Acceptable Substitutes
B.	Hinges	Ives	Hager
C.	Locks, Latches & Cylinders	Schlage	District Standard No Sub
D.	Exit Devices	Von Duprin	District Standard No Sub
E.	Closers	LCN	District Standard No Sub
F.	Push, Pulls & Protection Plates:	Ives	Matches existing District Standard
G.	Flush Bolts	Ives	Matches existing District Standard
H.	Dust Proof Strikes	Ives	Matches existing District Standard
I.	Coordinators	Ives	Matches existing District Standard
K.	Overhead Stops	Glynn-Johnson	Matches existing District Standard
L.	Thresholds	Zero	Pemko, National Guard
M.	Seals & Bottoms	Zero	Pemko, National Guard

**2.02 MATERIALS**

- A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
- B. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.
- C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" design, fastened with through-bolts and threaded chassis hubs. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
  - 1. Schlage "L" Series as scheduled with "17" Style Lever and "A" Style Rose.
- D. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of 1/4" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 2001 Grade 1 certified.
- E. Exit devices: Von Duprin as scheduled.
  - 1. 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.
  - 2. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
  - 3. 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. 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.

- D. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
  - 1. 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.
  - 2. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors.
- E. Door Stops: 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.
- F. Protection Plates: 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.
- G. Thresholds: As Scheduled and per details. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
- H. Seals: Provide silicone gasket at all rated and exterior doors.
  - 1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
- I. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- J. Silencers: 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.

### 2.03 KEYING

- A. This is an existing Schlage Keying System. All permanent cores and /or cylinders are keyed by the District.
- B. Furnish all cylinders in the Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI)
- C. Furnish construction keying for doors requiring locking during construction.
  - 1. For FSIC systems provide 23-030-ICX Full Size Construction Cores
  - 2. For FSIC systems provide ten 48-101-ICX Construction Keys
  - 3. For FSIC systems provide two 48-056-ICX Control Keys (const.)
  - 4. 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")
- D. Furnish all keys with visual key control.
  - 1. Stamp key "Do Not Duplicate".
- E. Furnish mechanical keys as follows:
  - 1. Supply 2 each EP ('0' Bitted) or E ('1' Bitted) change key per lock.

## 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) 2016 Edition.

### 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. 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.
- E. 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.

### 3.03 ADJUST AND CLEAN

- 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. 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

**3.04 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.

**3.07 Hardware Group No. 001 - INTERIOR / MEETING ROOM (EXAMPLE)**

XXA                    XXB

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53RD SPA	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**3.08 Hardware Group No. 002 - INTERIOR / OFFICE (EXAMPLE)**

XXC                    XXD

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53RD SPA	626	SCH
1	EA	FLOOR STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**3.09 Hardware Group No. 003 - INTERIOR / STORAGE (EXAMPLE)**

XXE                    XXF

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50RD SPA	626	SCH
1	EA	FLOOR STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**3.10** Hardware Group No. 0045 - INTERIOR / CLASSROOM (EXAMPLE)

XXG

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50RD SPA	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

**END OF SECTION**

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## SECTION 09 90 00 - PAINTING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes surface preparation and field painting and finishing of exposed exterior and interior items and surfaces.

#### 1.02 RELATED SECTIONS

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

#### 1.03 SYSTEM DESCRIPTION

- A. Paint exposed surfaces whether or not colors are designated, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
- B. Surfaces Not to be Painted:
  - 1. Exterior cast-in-place concrete and architectural concrete unless otherwise indicated.
  - 2. Stainless-steel fabrications.
  - 3. Factory-finished items specified in various Sections.
  - 4. Prefinished wall, ceiling, and floor coverings.
  - 5. Painting specified elsewhere and included in respective Sections, including but not necessarily limited to, shop priming.
  - 6. Code-Required Labels: Keep equipment identification and fire rating labels free of paint.
  - 7. Surfaces concealed in walls and above ceilings except as specifically indicated otherwise.
  - 8. Ducts, piping, conduit, and equipment concealed in walls and ceilings, unless specifically indicated otherwise.

#### 1.04 SUBMITTALS

- A. CALGreen Submittals:
  - 1. Product Data for CALGreen 5.504.4.3 - Finish Material Pollutant Control, Paints and Coatings: Product data and material safety data sheets (MSDS) for coatings, including printed statement of chemical composition and VOC content of each product used.
  - 2. Product Data Sheets for each product to be used as proof that each product meets the requirements of either Green Seal's GS-11 or GC-03 documents.
- B. Product Data: For each product indicated including block fillers and primers.
  - 1. Provide manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.

- C. Samples: For each type of paint system and in each color and gloss of topcoat indicated.

## **PART 2 - PRODUCTS**

### **2.01 SUSTAINABLE MATERIAL REQUIREMENTS**

- A. CALGreen: Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 5.504.4.3, shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board, Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table 5.504.4.3 shall apply.
- B. Aerosol paints and coatings. Aerosol paints and coatings shall meet the PWMIR Limits for VOC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.
- C. Refer to Section 01 81 13 - Sustainable Design Requirements for low-emitting materials requirements.

### **2.02 MANUFACTURERS**

- A. Owner's Standards Program: Where applicable, provide products under the terms and conditions of the Owner's standards program; no substitutions.
- B. Manufacturers: Products of the following manufacturers are listed in other Part 2 articles and use the abbreviated names shown in parentheses:
1. Kelly-Moore Paint Co. (Kelly-Moore): District Standard.

### **2.03 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.

### **2.04 PREPARATORY COATS**

- A. Crack Fillers: Factory-formulated acrylic emulsion crack fillers compatible with substrate and finish-coat materials indicated.
- B. Concrete Unit Masonry Block Fillers: Latex block fillers of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Kelly-Moore; 521 Block Filler.
- C. Typical Exterior Primers: Exterior latex-based primers of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal, Zinc-Coated Metal, and Aluminum Substrates: Rust-inhibitive acrylic metal primer.

- a. Kelly-Moore; 5725 DTM Primer/Finish.
2. Concrete and Masonry Substrates: Acrylic masonry primer.
  - a. Kelly-Moore; 247 Acry-Shield.
- D. Typical Interior Primers: Interior latex-based primers of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
  1. Gypsum Board Substrates: Zero VOC primer/sealer.
    - a. Kelly-Moore; 971 Acry-Plex Zero VOC.
  2. Ferrous-Metal, Zinc-Coated Metal, and Aluminum Substrates: Rust-inhibitive acrylic metal primer.
    - a. Kelly-Moore; 5725 DTM Primer/Finish.
  3. Concrete Substrates:
    - a. Kelly-Moore; 247 Acry-Shield.
  4. Wood Substrates (Smooth or Synthetic): Acrylic stain blocking primer.
    - a. Kelly-Moore; 255 Acry-Shield.
- E. Zinc-Rich Shop Primers for Items indicated to be Painted with High-Performance Coatings: As specified in Section 05 50 00 "Metal Fabrications"

## 2.05 EXTERIOR FINISH COATS

- A. Exterior Flat Acrylic Paint:
  1. Kelly-Moore; 1240 Acry-Shield.
- B. Exterior Low-Luster Acrylic Enamel:
  1. Kelly-Moore; 1245 Acry-Shield.
- C. Exterior Semi-Gloss Acrylic Enamel:
  1. Kelly-Moore; 1250 Acry-Shield.
- D. Exterior Wood Stain Finish:
  1. For Semi-Transparent Wood Finish: Exterior oil/alkyd wood stain.
- E. Exterior Wood Finish for Benches
  1. Waterborne transparent finish.
    - a. Cleaner/Neutralizer; Behr Premium All-In-One Wood Cleaner No. 63.
    - b. Penetrating sealer; Behr Premium Transparent Weatherproofing All-In-One Wood Finish, No. 500 Natural.
- F. Exterior High Performance Topcoats:
  1. Intermediate Coat: Epoxy intermediate coat as recommended by manufacturer for intended applications.
  2. Topcoats: Semigloss, acrylic polyurethane enamel.
    - a. Tnemec; Series 1075 Endurashield.

## 2.06 INTERIOR FINISH COATS

- A. Interior Flat Zero VOC/Low Odor Acrylic Paint:
  1. Kelly-Moore; 1500 Enviro Coat.

- B. Interior Low-Sheen (Eggshell) Zero VOC/Low Odor Acrylic Enamel:
  - 1. Kelly-Moore; 1510 Enviro Coat.
- C. Interior Semigloss Zero VOC/Low Odor Acrylic Enamel:
  - 1. Kelly-Moore; 1520 Enviro Coat.
- D. Interior High Performance Topcoats:
  - 1. Intermediate Coat: Epoxy intermediate coat as recommended by manufacturer for intended applications.
  - 2. Topcoats: Semigloss, acrylic polyurethane enamel.
    - a. Tnemec; Series 1075 Endurashield.
- E. Interior Epoxy Floor Finish:
  - 1. Kelly-Moore; 15 Chemical Mastic High Build Epoxy, or Sierra Performance S40.
- F. Interior Acrylic (Water-Borne) Epoxy Wall Finish:
  - 1. Kelly-Moore; Devoe 4426 Tru-Glaze-WB.
- G. Interior Wood Stain and Sanding Sealer:
  - 1. Stain:
    - a. UGL; Zar wood stain.
  - 2. Sealer:
    - a. Rust-Oleum; Varathane Diamond 2000.
- H. Interior Satin Wood Varnish: Waterborne, acrylic/urethane.
  - 1. Rust-Oleum; Varathane Diamond 2002.
- I. Interior water-based latex intumescent paint; 60 percent solids; 33 g/L VOCs; Class A in accordance with ASTM E84; flat sheen; color standard off-white; apply in accordance with manufacturer's written instructions.
  - 1. Product: As manufactured by Firefree Coatings, Inc., "Ff 88"; Shield Industries, Inc., or equal.

**PART 3 – EXECUTION (OMITTED)**

**END OF SECTION**

## **SECTION 10 14 00 - SIGNAGE**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes: Furnishing all products, materials, finishes, supplies, equipment, tools, and transportation, and performing all labor and services necessary for, required in connection with, or properly incidental to furnishing and installing signage as described in this Section of the Specifications, shown on the accompanying Drawings, or reasonably implied therefrom, except as hereinafter specifically excluded. Work includes:
  - 1. Create final production artwork and layouts for each sign face.
  - 2. Furnish all materials required for each sign type.
  - 3. Furnish materials and labor associated with fabricating and finishing all signs.
  - 4. Provide packaging and transportation of all signs to the project site.
  - 5. Furnish material and labor required for installation of signage.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.02 REFERENCES**

- A. ADA - Americans with Disabilities Act
- B. CBC - California Building Code, 2019 Edition
  - 1. Chapter 10 - Means of Egress.
  - 2. Chapter 11B - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Publicly Funded Housing.

#### **1.03 SYSTEM DESCRIPTION**

- A. Design Requirements
  - 1. Design signs as required by ADA, CBC Chapters 10 and 11B, and in compliance with the District's standards.
  - 2. Fabricator shall provide all necessary services, labor, materials, equipment, supervision, and products required to fabricate and install all items included in this Section.
- B. Regulatory Requirements: Comply with jurisdiction, CBC, and ADA requirements for signage, to include Braille.

#### **1.04 SUBMITTALS**

- A. Project Schedule: Within 1 week after approval to proceed, Contractor shall submit a project schedule that includes time for submittals, product and material lead times, fabrication duration, and installation period.
- B. Sign Face Layouts: Submit 3 sets of scaled layouts of every sign face for District approval.

- C. Color Samples: Submit 3 sets of 6-inch by 6-inch samples of each color for approval. See Drawings for complete color and materials list.
- D. Product Data Sheets: Supply product data sheets for all products used in the manufacture and installation of signage.
- E. As-Built Drawings: Supply final as-built Drawings after completion of the punch list.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer shall have “in-house” manufacturing capabilities with experience in excess of 10 years in the architectural signage production business.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Acrylic Sheet: Rohm & Haas, or equal, sizes and thicknesses as shown.
- B. Photo Etched Zinc: Exterior grade ADA-compliant photo etched zinc by Dutton Architectural Signage (423/752-1300), or equal.
- C. Silicone Adhesive: Dow Corning, or equal; clear, unless otherwise specified.
- D. Adhesive Tapes: 3M, or equal.
- E. Paint Products: Where required, provide low-VOC Matthews Acrylic Polyurethane, or equal, in colors specified. All finishes shall be satin.
- F. Screen-Printing Enamel: Inktech, or equal.
- G. Engraving Substrate: Rowmark ([www.rowmark.com](http://www.rowmark.com)), or equal.
- H. Porcelain Enamel: KVO Industries, or equal.
- I. Sign Insert Brackets: JRS ([www.jrscoinc.com](http://www.jrscoinc.com); 626/967-2432), or equal.

#### **2.02 FABRICATION**

- A. Cutting and Finishing
  1. All materials shall be cut with proper equipment using sharp blades. Shapes shall have square corners, straight edges, and shall be sized as indicated on the Drawings. Blade/cutter marks and scratches will not be accepted.
  2. Materials shall be prepared and primed before painting according to product manufacturer’s instructions.
  3. Finishes shall be applied according to product manufacturer’s instructions, then properly cured and protected after application.

- B. Application of Graphics
  - 1. All graphics shall be cut and etched or printed to comply with the specified typeface and graphic shapes. Graphics and type shall be clean and crisp without deformation of characters, ticks, gaps, or irregularities. Radiused corners from cutting equipment is not acceptable.
  - 2. Finished surfaces shall be protected from damage during application of graphics.
- C. Packaging: Completed signs shall be packed for shipment to the project site to protect from damage.

**PART 3 - EXECUTION**

**3.01 COORDINATION AND INSPECTION**

- A. Signage Contractor shall coordinate with the District or General Contractor the proper timing of signage so as not to conflict with other work.
- B. Signage Contractor shall inspect the site prior to installation and give written notice of any conditions adversely affecting the installation of signage.
- C. Signage Contractor shall survey each sign location and take field dimensions as needed to ensure proper installation.

**3.02 INSTALLATION**

- A. Signs shall be installed plumb, level, and true. Align with adjacent work where shown.
- B. Signs shall be installed 60 inches from floor to center of sign and 2 inches from door frame, unless otherwise indicated on the Drawings.
- C. Signage Contractor shall provide all equipment, adhesives, and fasteners required to install all signs included in these documents.
- D. Sign location and surrounding surfaces shall be left clean and all debris related to signage installation shall be removed. Installed signs shall be wiped clean. Care shall be taken not to damage or soil surrounding surfaces. If damage or soiling is found to be caused by signage installation, costs for repair and cleaning of damaged or soiled surfaces shall be the responsibility of the Signage Contractor.

**3.03 PUNCHLIST AND PROJECT CLOSEOUT**

- A. Signage Contractor shall review all installed work with the District or District's Representative and make all required punchlist corrections. Once complete, the Signage Contractor shall back check all punchlist items and receive the District's final approval of installation.
- B. Deliver as-built Drawings to the District.

**END OF SECTION**

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## SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

#### 1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 21 - Fire suppression systems:

#### 1.03 SUBMITTALS

- A. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.
- B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Fire Extinguishers, Cabinets and Accessories:
  - 1. Kidde, a unit of United Technologies Corp: [www.kidde.com/#sle](http://www.kidde.com/#sle).
  - 2. Larsen's Manufacturing Company, a unit of Morris Group International: <https://www.larsensmfg.com>.
  - 3. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).

#### 2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Class: 3-A:40-B:C type.
  - 2. Size: 5 pound minimum.
  - 3. Finish: Baked polyester powder coat, red color.
  - 4. Temperature range: Minus 40 degrees F to 120 degrees F.

- C. Dry Chemical Type Fire Extinguishers: (Kitchen) Stainless steel tank, with pressure gauge.
  - 1. Class: K type.
  - 2. Size: 1.6 gallons.
  - 3. Finish: Polished stainless steel.
  - 4. Temperature range: Minus 20 degrees F to 120 degrees F.

### **2.03 FIRE EXTINGUISHER CABINETS**

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
  - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- C. Fire Rated Cabinet Construction: One-hour fire rated.
  - 1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.
- D. Cabinet Configuration: Semi-recessed type.
- E. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- F. Extinguisher Brackets: Formed steel, chrome-plated.
- G. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings. Refer to drawings for mounting height to comply to accessibility requirements.

**END OF SECTION**

## **SECTION 22 00 00 – PLUMBING**

### **PART 1 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Work included in Division 22 Plumbing: Provide all materials, equipment, fabrication, installation and tests as noted in Contract Documents in conformity with applicable codes and authorities having jurisdiction.
- B. Provide all work described in Contract Documents.
- C. Plumbing related demolition work for existing piping.
- D. Comply with such general conditions of the specifications as are applicable, including, but not limited to:
  - 1. Instructions to Bidders as established by the General Contractor
  - 2. General and Special Conditions as established by the General Contractor

#### **1.02 SCOPE OF WORK COORDINATION**

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

#### **1.03 EXISTING SYSTEMS AND UTILITIES SHUTDOWN**

- A. During the entire course of construction, the existing plumbing systems shall be in operation. Shutting down of these systems shall not be permitted except for designated periods. During these shut-down periods, all connections to existing piping and associated devices shall be made and completed. Piping shall be pre-measured, prefabricated, and pre-tested ready for final connection in order to cut shutdown time to absolute minimum
- B. Provide temporary by-pass piping, whether shown or not, as required to keep systems in continuous operation at times other than the shutdown period, while portions of the systems are being worked on.
- C. Any interruption in service of occupied areas requires 2 weeks' notice to both the property manager and the Client's project manager and should occur before 7am or after 6pm as coordinated with the Client's project manager.
- D. System shutdown shall be coordinated with the Director of Facilities Office and the Project Inspector to occur when the owners/tenants are not occupying the space.
- E. Any necessary overtime work, including weekends, evenings and holidays, shall be included in the contractors bid. Overtime work shall be agreed upon by the Director of Facilities Office, Project Inspector, and the Owner's Representative.

#### **1.04 DESCRIPTION & SCOPE**

- A. Work included: Engineering, materials, equipment, fabrication, installation, starting, testing and commissioning:
- B. All work shall be in accordance with all Division 22 specifications issued with the plumbing design documents.

- C. The plumbing systems for this project are to be designed and built using a design/build approach. The design/build Plumbing Contractor shall prepare a proposal for complete design and construction services based on this performance specification along with architectural and structural drawings and other program requirements.
- D. Contractor proposals shall include the following:
  - 1. A narrative of the proposed systems design
  - 2. Any exceptions to these specifications
  - 3. Completed bid form:
    - a. Total Price
    - b. Breakout prices. Where breakout prices are requested in bid form, include materials, taxes, freight, installation, and mark-up, as applicable.
    - c. Additive/deductive alternates. Alternates listed herein must be bid. Additional voluntary alternates are strongly encouraged.
    - d. Unit prices, as specified herein.
- E. Contractors selected for the short list shall prepare the following for the interview with the design team (This information may also be provided with proposals, at contractor's option):
  - 1. A preliminary schedule or detailed list of equipment showing proposed manufacturers, models, sizes, etc.; provide cut sheets of major equipment and plumbing fixtures.
  - 2. Sketches or drawings showing the locations and dimensions of major equipment such as; water heaters, pressure reducing valves, backflow preventers, etc.
  - 3. Sketches or drawings showing the locations and dimensions of pipe risers and stacks
  - 4. Description of plumbing requirements serving work of other trades such as make-up water, floor sinks, floor drains, natural gas, condensate, etc.; use coordination form provided at the end of this specification.
  - 5. Description of electrical requirements
  - 6. Description of control system including manufacturer, installing contractor, description of system architecture, and other descriptive material
  - 7. Proposed mechanical room requirements if other than what is shown on current architectural plans
  - 8. Requirements for concrete and steel work such as equipment bases under water heaters, pumps, etc.
  - 9. Resumes of personnel who will be assigned to the project, including:
    - a. Design Engineer
    - b. Construction Manager
    - c. Field Superintendent

#### **1.05 ALTERNATES AND UNIT PRICES**

- A. Alternates
  - 1. Any proposed by Plumbing Contractor at his option.

#### **1.06 DESIGN DOCUMENTS**

- A. An employee of the Plumbing Contractor shall serve as Engineer-of-Record (third party consultant acceptable only if consultant has significant plumbing design/build experience).

- B. The Plumbing Contractor/engineer shall maintain a design and detailing schedule consistent with those of the architect and other engineers to produce working drawings and shop drawings in a timely and professional manner, consistent with the project construction schedule.
- C. All Plumbing system design documents shall be prepared under the supervision of the Engineer-of-Record.
- D. Calculations:
  - 1. Plumbing system(s) calculations and equipment selections shall be supervised and reviewed by a registered professional engineer.
  - 2. Provide calculations for review by the Owner.
- E. LEED Core & Shell v4.0 for Core & Shell
  - 1. The contractor shall provide all required calculations and documentation for the following LEED credits. Those not listed will be documented by others.
    - a. Water Efficiency
      - 1) WEp2: Indoor Water Use Reduction – Building Water Use
      - 2) WEc2: Indoor Water Use Reduction – 35% Reduction minimum required
  - 2. Calculations shall be performed and documentation posted prior to the completion of the Construction Documents phase.
- F. Design documents
  - 1. All design drawings shall be created using Revit 2018.
    - a. Title block and sheet size as determined by Architect.
    - b. Design shall be coordinated with architecture and structure at the start of CD phase. Detailed clash detection shall occur at the 50% CD issue. Refer to Architect's Clash Detection plan for additional information.
    - c. Final construction drawings shall be Level of Development 300.
    - d. Shop drawings and As-Built model shall be Level of Development 350.
  - 2. Include, at minimum, the following drawings:
    - a. Equipment schedules
    - b. Floor plans: scale to match architectural drawings or larger, minimum 3/64" scale; Equipment Rooms & Toilet Rooms: 1/4" scale
    - c. Piping diagrams
    - d. Details

### 1.07 REFERENCE STANDARDS

- 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. 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.
- C. Requirements of Regulatory Agencies
  - 1. In accordance with the requirement of Division 1 General Requirements

2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules and regulations.
3. When contract documents exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.
4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.
5. Seismic construction and restraints: In accordance with requirements of Title 17 of California Administrative Code.
6. Comply with the Safety Orders issued by California Occupational Safety and Health Act, COSHA and any other safety, health or environmental regulations of the State of California and any districts having jurisdictional authority. Where an omission or conflict appears between COSHA requirements and the Drawings and Specifications, COSHA requirements shall take precedence.
7. Applicable codes and standards as listed below, in addition to others specified in individual sections
  - a. CEC – California Electrical Code with City of Oakland Amendments
  - b. CBC – California Building Code with City of Oakland Amendments
  - c. CMC – California Mechanical Code with City of Oakland Amendments
  - d. CPC – California Plumbing Code with City of Oakland Amendments
  - e. City and County Codes and Amendments
  - f. California Code of Regulations, including Titles 8, 17, 19, 20, 21, 22 and the California Building Standards Code Part 2, Basic Building Regulations.
  - g. Peralta Community College District Standards.
- D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 22 Plumbing, in addition to other standards which may be specified in individual sections.
- E. All base material shall meet ASTM and ANSI standards
- F. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped
- G. All Electrical Devices and Wiring
  1. Conform to standards of CEC/NEC
  2. All devices UL or ETL listed and identified
- H. Guidelines and Standards: The latest edition of guidelines and standards published by the following groups will govern the Mechanical Systems and associated support system design. The systems shall be designed to meet or exceed these guidelines and standards.

AGA	American Gas Association
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials

AWWA	American Water Works Association
AWS	American Welding Society
COSHA	California Occupational Safety and Health Act
ETL	Intertek Semko (Formerly Electrical Testing Laboratories)
GISO	General Industry Safety Orders
HI	Hydraulic Institute
IEEE	Institute of Electrical and Electronic Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHPD	Office of Statewide Health Planning and Development
PDI	Plumbing and Drainage Institute
SFA	California State and Local Fire Marshall
UL	Underwriters' Laboratories, Inc.

**1.08 QUALITY ASSURANCE**

- A. Supply all equipment and accessories in compliance with the applicable standards listed in Paragraph 1.06F.1 and with all applicable national, state and local codes.
- B. All equipment and accessories shall be new and the product of a manufacturer regularly engaged in its manufacture.
- C. All items of a given type shall be the products of same manufacturer.
- D. All work in Section 22 00 00 Plumbing shall be commissioned.

**1.09 SUBMITTALS**

- A. LEED Submittal Requirements
  - 1. Each material submittal shall include a completed Green Building Material Certification Form (GBMCF) per Section 018115 and required backup documentation.
  - 2. All products shall comply with LEED Material Performance Requirements per Section 018120.
- B. Follow procedures specified in Section 23 00 00 Heating Ventilating & Air Conditioning.
- C. Layout Shop Drawings: see Section 23 00 00 Heating Ventilating & Air Conditioning
- D. Tables of Submittals Required
  - 1. Submit layout shop drawings, product data, or samples according to the following table
  - 2. "R" in Submittal Data Column indicates submittal for Owner's Representative's review

3. "R" in Layout Shop Drawings Column indicates item shall be included in shop drawings for Owner's Representative's review
4. "M" indicates submittal shall be included in service and maintenance and shall be included as part of O&M Manual
- 5.

ITEM	LAYOUT SHOP DRAWINGS	SUBMITTAL DATA REQUIRED
BACKFLOW PREVENTION DEVICES	R	R,M
DRAINS, FLOOR SINKS AND CLEANOUTS	R	R, M
EMERGENCY SHOWER AND EYEWASH ASSEMBLY	R	R, M
PLUMBING PIPE AND FITTINGS	R	R, M
INSULATION		R, M
TRAP PRIMERS	R	R, M
PRESSURE REDUCING VALVES & PRESSURE REGULATING VALVES	R	R, M
PLUMBING VALVES	R	R, M
PIPE SUPPORTS, HANGERS, SEISMIC BRACING, ANCHORS, INSERTS AND STRUCTURAL ATTACHMENTS	R	R, M
SANITARY SEWER PUMPS AND STORM DRAIN PUMPS	R	R, M
THERMOSTATIC MIXING VALVES & TEMPERING VALVES	R	R, M
WATER HEATING EQUIPMENT & ASSOCIATED EQUIPMENT	R	R, M
WATER STERILIZATION		R, M

**1.10 COMPLETION REQUIREMENTS**

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

**1.11 DEFINITIONS**

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

**1.12 JOB CONDITIONS**

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

### 1.13 REVIEW OF CONSTRUCTION

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

### 1.14 SCHEDULE OF WORK

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

### 1.15 GUARANTEE

- A. As specified in Section 23 00 00 Heating Ventilating & Air Conditioning

### 1.16 SYSTEM DESIGN AND WORK

- A. Utility Stub-outs are as follows:
  - 1. New Utility Building - Storage Room:
    - a. (1) 4" sanitary sewer; (1) ¾" domestic cold water and (1) 3" storm drain.
  - 2. Cooling Tower Yard/Room
    - a. (1) 2" domestic cold water; (1) 6" sanitary sewer, and (1) 6" storm drain.
  - 3. All stub-outs will be stubbed out 5 feet from the Building perimeter for connection to the onsite utility laterals as provided under the Civil Section of work. Coordinate all stub-outs with Civil Engineer.
  - 4. Each gravity sanitary sewer and storm drain stub-out will include a cleanout to grade
- B. Sanitary Soil, Waste and Vent Piping Systems: New Utility Building - Storage Room:
  - 1. Provide complete sanitary soil, waste, vent and trap primer piping systems including piping, fittings, supports, acoustical isolation components, seismic bracing, and cleanouts.
  - 2. Provide standpipe drain assembly complete with trap and trap priming assemblies to receive fire sprinkler system drainage requirements
  - 3. Provide (1) 4" floor sink and associated waste and vent piping to serve the main cold water service backflow preventer. Size drain and waste piping to accommodate relief from the main backflow preventer.
  - 4. Provide drainage provisions serving HVAC equipment as noted hereinafter.
  - 5. Provide standpipe drain assembly complete with trap and trap priming assemblies to receive fire sprinkler/standpipe system drainage requirements
  - 6. Coordinate all space requirements with the Architect for equipment space requirements.
  - 7. Coordinate all space requirements with the Architect for vertical and horizontal pipe runs
  - 8. Floor sink shall include waste, vent and trap priming piping.
  - 9. Coordinate locations of all vents through roof with the Architect.
- C. Rainwater Leader, Overflow Drain and Storm Drainage Piping Systems: New Utility Building - Storage Room:
  - 1. Provide complete storm drain, rainwater leader, and overflow drain piping for the entire building. Size piping per the CPC and the City of Oakland requirements.
  - 2. Provide roof drain and overflow drain for the building.
  - 3. Coordinate all space requirements with the Architect for vertical and horizontal pipe runs
  - 4. Coordinate all vertical & horizontal pipe runs and sleeve requirements with the Structural Engineer.

- D. Domestic (Potable) Cold Water System New Utility Building - Storage Room:
  - 1. Provide complete domestic cold water system for the building.
  - 2. Provide exterior wall hydrant with a shut-off valve for each wall hydrant
  - 3. Provide supply piping and isolation valve for each wall hydrant and trap primer assembly.
  - 4. Provide supports, hangers and seismic bracing for piping systems.
  - 5. Provide piping, hangers, valves and associated devices.
  - 6. Provide backflow preventer and provide unit as specified complete with certification.
  - 7. Coordinate all space requirements with the Architect for equipment space requirements.
  - 8. Coordinate all vertical & horizontal pipe runs and sleeve requirements with the Structural Engineer.
  
- E. Plumbing Work inside Central Plant:
  - 1. Existing separate cold water makeup connection with backflow preventers for the HVAC HHW and CHW systems. Remove existing backflow preventer and provide dedicated backflow preventer for each system. Make final connection to each HVAC system.
  - 2. Existing natural gas connections for each existing boiler for the HVAC hydronic system. Remove existing gas connection including piping, valves, supports and seismic bracing. Provide gas connection for each new HVAC Boiler; provide all valves, supports and seismic bracing. Make final connection to each boiler. Pipe up all new gas pressure regulator relief vents and terminate to the exterior
  - 3. Remove existing indirect drains including valves, piping and supports. Provide indirect drains including valves, piping and supports. Terminate all indirect drains over existing drainage provisions.
  
- F. Plumbing Work for Building E.
  - 1. Provide reduced pressure backflow preventer for the Building E Heating Hot Water (Hydronic HVAC). Make final connection to serve the HVAC connection.
  
- G. Plumbing Work for Steam System Demolition:
  - 1. Remove existing gas connection including piping, valves, supports and seismic bracing to each boiler.
  
- H. Plumbing Work at Existing Cooling Tower Yard.
  - 1. Remove existing cold water makeup piping including valves, piping and supports.
  - 2. Remove existing indirect waste piping including valves, piping and supports.
  - 3. Remove existing emergency shower and eyewash assembly.
  
- I. Plumbing Work at New Cooling Tower Yard.
  - 1. Provide cold water piping from stub-out and run to emergency shower and eyewash assembly through reduced pressure backflow preventer. Provide cold water piping from stub-out to cold water makeup with backflow preventer for the cooling towers. Source of this water is from the on-site existing site water main.
  - 2. Provide new sanitary drainage provisions inside the enclosure for the cooling towers. Piping from the drainage provisions will be piped to a duplex sewage pump assembly inside the enclosure well. Sewage pump assembly will include two sewage pumps, pump controls, pump discharge piping and a control panel. Pump discharge piping from each pump will combine inside the enclosure prior to exiting with a single gravity sanitary sewer stub-out for the Civil Engineer to pipe to the site sanitary sewer system. Provide backwater valve assembly (along wall) on the 6" gravity line SS prior to exiting the cooling tower enclosure and before the 6" SS stub-out. Provide SS basin vent and terminate above normal finished grade and to concur with code requirements.

3. Storm drainage provisions inside the enclosure well to consist of (2) 4" size area drains. 6" storm drain piping from these drainage provisions will be piped to a duplex storm drain pump assembly inside the enclosure well. Storm drain pump assembly will include two storm drain pumps, pump controls, pump discharge piping and a control panel. Pump discharge piping from each pump will combine inside the enclosure prior to exiting with a single gravity storm drain stub-out for the Civil Engineer to pipe to the site storm drain system. Provide backwater valve assembly (along wall) on the 6" gravity line SD prior to exiting the cooling tower enclosure and before the 6" SD stub-out. Provide SD basin vent and terminate above normal finished grade and to concur with code requirements.
- J. Fan Coil in Engineer's Office
  1. Provide condensate drain assembly for new Fan Coil Unit in the Engineer's Office; connect piping to the fan coil unit.
  2. Coordinate with HVAC for exact locations
- K. Drainage Provisions for HVAC at Cooling Tower Yard
  1. Provide a dedicated 6" mechanical equipment drain to serve each cooling tower. Mechanical equipment drains to each include waste, vent and trap priming provisions.
  2. Provide a dedicated (2) 3" floor sinks to serve HVAC pump assemblies in the cooling tower yard. Floor sinks to include waste, vent and trap priming provisions.
  3. Pipe sanitary sewer waste piping to the duplex sewage pump assembly.
  4. Coordinate with HVAC for exact locations.

#### 1.17 CRITERIA

- A. Sizing Criteria
  1. Sanitary Soil, Waste and Vent
    - a. System sizing shall be per the requirements of the City of Oakland Plumbing Code.
- B. Sizing Criteria
  1. Storm Drain, Rainwater Leader and Overflow Drain
    - a. System sizing shall be per the requirements of the City of Oakland Plumbing Code.
- C. Water System Design and Distribution:
  1. General:
    - a. Piping systems shall be designed not to exceed a maximum velocity of 4 feet per second.
    - b. Piping shall not be run through noise sensitive areas.
    - c. Piping shall not be run through elevator machine rooms, IDF, server rooms electrical rooms, even where above ceilings.
    - d. Piping shall not be exposed on the roof unless absolutely necessary due to architectural constraints or acoustical requirements.
  2. Access: Space shall be provided around all plumbing equipment as recommended by the manufacturer for routine maintenance and inspection replacement. Access doors or panels shall be provided in walls and/or ceilings as required for adjustment, in-site inspection of the following:
    - a. Valves
    - b. Shock absorbers
    - c. Trap priming assemblies.

- d. Tempering valves
- D. Sanitary Soil, Waste, and Vent Piping Distribution:
  - 1. Piping shall not be run through elevator machine rooms, electrical rooms, data rooms or telephone rooms.

## PART 2 PRODUCTS

### 2.01 LEED MATERIAL PERFORMANCE

- A. All products shall comply with LEED Material Performance Requirements per Section 018120.

### 2.02 STATE OF CALIFORNIA AB 1953

- A. Materials provided under this section of work shall be in compliance with State of California AB 1953

### 2.03 EMERGENCY SHOWER AND EYEWASH ASSEMBLY

- A. Guardian Equipment G1991 or equal.
- B. Corrosion resistant, all stainless steel construction, combination eyewash and shower safety station with stainless steel shower head, internal 20 GPM flow control, stainless steel eyewash bowl, stainless steel flag handle and floor flange, 1¼" IPS Schedule 40 stainless steel pipe and fittings, 1" IPS and ½" IPS U.S. made stainless steel stay-open ball valves, and polished stainless steel pull rod. Unit shall have (2) polypropylene GS-Plus™ spray heads with integral "flip-top" dust covers, filters, and 1.6 GPM flow control orifices mounted on a stainless steel head assembly. Unit shall include ANSI compliant sign.
- C. Unit shall meet or exceed ANSI Z358.1

### 2.04 DRAINS AND CLEANOUTS:

- A. Zurn, Watts, or equal
- B. Roof Drains, (RD): Z100, galvanized cast iron body with removable galvanized cast iron dome, extensions as required, clamp ring, gravel stop, drain receiver, and adjustable collar
- C. Overflow Drains, (OD): Z100, galvanized cast iron body with removable galvanized cast iron dome, extensions as required clamp ring, gravel stop, drain receiver, adjustable collar and plastic standpipe. Set standpipe 2" above roof level.
- D. Area Drains (AD-1): J.R. Smith 2140 Series, or equal, 12-inch diameter top drain, complete Dura-coated cast iron body with bottom outlet, seepage pan, sediment bucket, combination membrane flashing clamp, extension frames, frames shall be for heavy-duty ductile iron grates. Grates shall be complete with vandal proof secured top.
- E. Mechanical Equipment Drains (MED): 3220, Z108, Galvanized cast iron body and internal galvanized dome strainer, clamp ring, drainage flange drain receiver, extensions, adjustable collar and 2" high water dam.
- F. Floor Sinks, (FSK): cast iron floor sink with acid-resisting porcelain enameled interior, internal dome, nickel bronze frame. **Set frame flush with the finished floor.** All floor sinks shall be provided with a ½" trap primer connection.
  - 1. FSK: Zurn 1960, 8" round x 6" deep, with ½ grate

- G. Floor Cleanouts, (FCO): Z1400, floor level cleanout with round top , cast iron body with clamp ring and flange, neoprene seal, bronze threaded plug and scoriated nickel-bronze cover.
- H. Cleanouts: Z1440A, cast iron body, sealed with raised head bronze threaded plug,
- I. Wall Cleanouts (WCO): Z1445-4, smooth chromium-plated bronze access cover and frame. Unit shall be complete with a cleanout assembly and smooth chromium-plated bronze access cover and frame.
- J. Furnish suitable wrenches for each style of cleanout plug or cap.
- K. All floor drains and floor sinks shall be trapped, primed and vented.
- L. All floor drains, floor sinks, and floor cleanouts in areas with epoxy flooring or a similar float-on finish shall have integral extended flange, same material and drain body to receive the epoxy or similar flooring. Contractor shall confirm locations with the Architect.

#### **2.05 BACKWATER VALVE ASSEMBLY**

- A. Zurn Z1090 or approved equal, flapper type backwater valve; 6 inch size.

#### **2.06 WATERPROOF SLEEVE ASSEMBLY**

- A. Thunderline Corp., Link-Seal, or approved equal, complete with wall sleeve with wall anchor, and water stop plate. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill the annular space between pipe and sleeve, complete with pressure plates and cadmium plated nuts and bolts. Install at all below grade penetrations.

#### **2.07 SANITARY SEWER PUMPS (SSP-1 & SSP-2) & STORM DRAIN PUMPS (SDP-1 & SDP-2)**

- A. Weil, Paco, or equal
- B. Each shall be a non-clog, submersible duplex pumping unit and disconnect system to permit installation and removal of each pump without entering the wet pit. Each pump shall UL Listed explosion-proof motor, complete with UL approved submersible electric cable, length as required. Each motor shall contain moisture sensing probes and a sealed oil-filled chamber that will detect the inflow of pumpage past the outer seal which in turn will relay a signal warning of an impending motor seal failure.
- C. Disconnect system shall be designed to permit easy removal of each pumping unit for inspection or service. The pumps when lowered into place shall be automatically connected to the discharge piping. There shall be no need for personnel to enter the wet pit to inspect or service the pumps. Each pump shall be complete stainless steel lifting rope (length as required). 2" diameter galvanized steel guide rails and mounting brackets, bronze yolk, galvanized iron base elbow and discharge flange kit.
- D. Furnish and install a wall mounted NEMA 4X UL labeled duplex control panel complete with circuit breaker disconnect switches, magnetic motor starters with ambient compensated overload protection in all three legs, HAND-OFF-AUTO selector switches, automatic electric alternator, moisture sensing relays with alarm light to warn of impending motor seal failure, 120 volt control circuit transformer, running lights, high water alarm with horn, silencer and auxiliary contacts for remote alarm to the BAS. Control panel shall be factory assembled and wired for automatic operation. Furnish and install 4 intrinsically safe relay level control switches for lead and lag pump operation, pumps off, and high water alarm operation. Each level control shall be complete with PVC control cable, length as required.
- E. Furnish and install 60" diameter, 1/4" steel flanged pump basin. Basin shall be a minimum of 1/2" thick steel at the bottom. Each shall be complete with anti-floatation collar and 1/2" galvanized

steel bolted and gasketed gastight and odor tight cover plate. Provide and install all necessary connections in and out of each basin.

- F. Basins shall be coated inside and out as follows:
1. Sandblast all metal to white metal SSPC-SP-5
  2. Apply one coat of Koppers 654, or equal, coal tar epoxy resin primer to a minimum dry film thickness of 3 mils
  3. Apply one coat of Koppers 300-M, or equal, coal tar epoxy resin to a minimum dry thickness of 8-10 mils. Allow overnight curing
  4. Apply second and final coat of Koppers 300M, or equal, coal tar epoxy resin to a minimum dry film thickness of 8-10 mils.
  5. All preparation, coating, procedures and safety precautions shall be in strict accordance with manufacturer's directions.
  6. Basin exterior sides and exterior bottom to be concrete encased

## **2.08 SHOCK ABSORBERS**

- A. Zurn, Watts, or District approved equal.
- B. Provide complete with a line size shut-off valve.
- C. Size of units shall be per PDI (Plumbing and Drainage Institute) Standards

## **2.09 TRAP PRIMERS**

- A. MIFAB, Zurn or District approved equal.
- B. 3 psi pressure drop actuated type.
- C. Provide complete with a line size shut-off valve and union.
- D. Trap priming provisions shall be provided for all floor drains and floor sinks

## **2.10 HOSE BIBBS**

- A. Hose Bibbs: Acorn, Woodford

## **2.11 WATER HEATING EQUIPMENT FOR EMERGENCY SHOWER AND EYEWASH ASSEMBLY**

- A. Electric Water Heater (EWH)
  1. Steibel Eltron CES Series , or equal
  2. 60KW, 480 volts with NEMA 4X enclosure. Unit complete with wall brackets.
  3. Provide a Smitty or equal drain pan. Provide drain piping from pan outlet and terminate to spill over floor sink
  4. The Contractor shall arrange and pay for a licensed Structural Engineer in the State of California to provide structural calculations for seismic restraints of each water heater
  5. General Contractor to provide a 4" high concrete pad below each EWH unit
- B. Plumbing Expansion Tank: Bell and Gossett or Amtrol bladder type (certified for potable water use). Expansion tank shall be sized per the recommendations of the tank manufacturer.
- C. All controls by Division 25 BAS.

## **2.12 THERMOSTATIC MIXING VALVE**

- A. Guardian G6040 or equal; ANSI Z358.1 compliant; unit to supply tepid water to the emergency shower and eyewash in the Cooling Tower Yard
- B. Provide strut channel assemblies with backing for wall mounting

**2.13 PRESSURE/TEMPERATURE TEST PLUG**

- A. Solid brass with valve core
- B. Valve core: Nordel or equal
- C. Fitted with a color coded and marked cap with gasket
- D. Suitable for 500 pounds per square inch gage and 275 degrees Fahrenheit for water systems
- E. Pete's Plug: No. 110/100XL with yellow cap or equal

**2.14 PIPE MATERIALS AND JOINING SYSTEMS:**

- A. Shall be rated to handle the designed working pressures and designed working temperatures.
- B. Sanitary Soil, Waste and Vent Piping: ASTM A74A and CISPI 301 standard weight cast iron soil pipe and fittings. All piping & fittings shall have a standard rust inhibiting coating and shall carry the CISPI mark
  - 1. Below Slab and Below Grade: Cast iron hubless soil pipe and fittings with Husky 4000, Clamp-All, or equal heavy duty, type 304 stainless steel couplings with neoprene gasket. Piping shall be wrapped within 8 mil thick polyethylene tubing.
  - 2. Above Slab on Grade: Cast iron hubless soil pipe and fittings with Husky 2000, Clamp-All, or equal heavy duty, type 304 stainless steel couplings with neoprene gasket.
  - 3. Rainwater Leader, Storm Drain, and Overflow Drain Piping: Same as for sanitary soil, waste piping except as otherwise noted on plans.
- C. Rainwater Leader, Overflow and Storm Drainage Piping: Same as for sanitary soil, waste piping.
- D. Main Cold Water Service Entrance:
  - 1. Type "K" copper tubing and wrought copper sweat type fittings and brazed joints. Copper tubing and fittings shall be per ANSI B16.18 and ANSI B16-22. Copper tubing and fittings below grade shall be wrapped within 8 mil thick polyethylene tubing.
- E. Domestic Cold Water , Hot Water & Tepid Piping:
  - 1. Piping within the Building and above Slab on Grade: Type "L" copper tubing and wrought copper sweat type fittings per ANSI B16-22, ASTM B 813 and ASTM B 828. Solder shall be lead free.
- F. Trap Priming Piping
  - 1. Piping below Slab on Grade (Trap Priming): Type "K" soft annealed copper tubing with no fittings below the slab. Copper tubing and fittings below grade shall be wrapped within 8 mil thick polyethylene tubing. Trap priming piping below slab on grade shall be sloped.
  - 2. Piping above Slab on Grade Type "L" copper tubing and wrought copper sweat type fittings per ANSI B16-22, ASTM B 813 and ASTM B 828. Solder shall be lead free.
- G. Natural Gas Piping
  - 1. Concealed gas piping within the building shall be Schedule 40 black steel pipe conforming to ASTM A-53 using 150 pound banded malleable iron screwed fittings for piping 2" and smaller and weld type steel fittings for all sizes 2-1/2" and larger.

2. Exposed gas piping outside the building shall be Schedule 40 galvanized steel pipe conforming to ASTM A-53 using galvanized 150 pound banded galvanized malleable iron screwed fittings for piping in sizes 2" and smaller and seamless weld type steel fittings for all piping sizes 2-1/2 and larger.
- H. Condensate Drain Piping: Type "L" copper tubing and wrought copper sweat type fittings. Solder shall be lead free.
- I. Sanitary Sewer and Storm Drain Pump Discharge Piping: Schedule 40 galvanized steel pipe with galvanized grooved joint fittings.
- J. Relief Valve and Indirect Drain Piping: Type "M" copper tubing and wrought copper sweat type fittings. Solder shall be lead free.

### **2.15 PIPING SYSTEM ACCESSORIES**

- A. Piping system components shall be selected for maximum design operating pressure based on static head and pressure relief valve setting.
- B. Strainers:
  1. Watts, or equal
  2. Unleaded bronze "Y-pattern" body to match piping material
  3. Provide valve with hose bib adapter with cap for all strainers
  4. Provide strainers at the inlet to all hot water circulating pumps.
- C. Safety Relief Valves
  1. Size: ASME Code
  2. Similar to Watts No. 740
  3. Adjustable
- D. Thermometers
  1. Weksler, Ashcroft, or equal
  2. Stainless steel construction and range of 30 °F to 240 °F

### **2.16 PRESSURE REDUCING VALVES**

- A. All valves shall be rated to handle the designed working pressures and designed working temperatures.
- B. For Cold Water 2-1/2 inches and Smaller (Domestic)
  1. Bronze body, bronze trimmed and threaded inlet & outlets
  2. Equal to Watts Series 223S
  3. Unit shall be complete with line size strainer upstream of pressure reducing valve

### **2.17 REDUCED PRESSURE BACKFLOW PREVENTERS (RPBP)**

- A. Watts, or equal, reduced pressure device
- B. All valves shall be rated to handle the designed working pressures and designed working temperatures
- C. Each unit shall be complete with upstream strainer, check valves, relief valve, ball valves, and test cocks. Furnish and install air gap drain funnel at each reduced pressure device, connect drain piping full size, and terminate over drainage provisions.

- D. All units shall be listed on the District's list of approved devices.
- E. Contractor shall arrange and pay for device certification per the Authority Having Jurisdiction

### **2.18 BALL VALVES**

- A. In compliance with State of California AB 1953
- B. All valves shall be rated to handle the designed working pressures and designed working temperatures.
- C. 2-1/2" inches and smaller
  - 1. Bronze
  - 2. 316 SS trim
  - 3. Three piece body
  - 4. Full port
  - 5. 600 pounds per square inch water on gage (WOG) at 100 degree F, 125 pounds per square inch saturated steam
  - 6. Equal to Nibco
    - a. Threaded - T-595-Y-66- LF
    - b. Soldered - S-595-Y-66-LF
  - 1. For piping systems with insulation: Provide valve handles with extended neck assembly.

### **2.19 CHECK VALVES**

- A. In compliance with State of California AB 1953
- B. All valves shall be rated to handle the designed working pressures and designed working temperatures.
- C. Milwaukee UPBA 100/100S

### **2.20 HANGERS & SUPPORTS**

- A. Kin-line, Superstrut, or equal
- B. Where pipe is insulated, protect insulation at hangers by installing a 22 gauge shield and clamp sized to allow pipe insulation to pass continuously through the hanger.
- C. For all hot water, cold water and condensate drain piping sizes, provide 360 degree high density calcium silicate insert within shield.
- D. Refer to paragraph hereinafter "PIPING ISOLATION FOR NOISE CONTROL". Hangers and supports shall accommodate noise control assemblies and all associated components.
- E. Provide Holdrite or equal, pipe supports for piping in wall, fixture stub-outs and rough-in brackets
- F. Exposed hangers and supports shall be stainless steel.
- G. Intervals and spacing of supports shall be as noted in the CPC

### **2.21 ANCHORS, INSERTS AND FASTENERS**

- A. All anchors and inserts shall be installed according to the ICBO standards

- B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following
  - 1. ICBO evaluation report
  - 2. Lab test report verifying compliance
- C. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips
- D. All over-head concrete anchors or inserts shall be selected to comply with the ICBO report or CBC table for the anchor or insert
- E. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.
- F. Bolts and nuts
  - 1. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576
  - 2. Bolts, underground: ASTM A325

## 2.22 SEISMIC RESTRAINTS

- A. General
  - 1. Capable of safely accepting indicated external forces without failure
  - 2. Maintain equipment, piping and ducts in a captive position
- B. Criteria: Design for seismic forces specified by the Structural Engineer
- C. Seismic Restraints
  - 1. Hangers and Supports: Any manufacturer who can verify compliance with SMACNA standards and the California Building Code.
  - 2. Strut - Channel Framing: Any manufacturer who can verify compliance with the ICBO standards
  - 3. Anchors - Drill in, wedge type: Any manufacturer within the ICBO standards approved for seismic.
  - 4. Restraints exposed outside shall be stainless steel.
- D. Bracing system: Provide one of the following methods as most applicable for each brace
  - 1. Material used, except for pipes, shall be structural steel with ASTM A36. Steel pipes shall conform to ASTM A501
  - 2. Complete system of factory fabricated components
  - 3. Complete system of job fabricated components
  - 4. Miscellaneous metal structural shapes

## 2.23 EQUIPMENT CONNECTIONS:

- A. At a minimum, provide at all equipment connections:
  - 1. Isolation valves and union for each connection
  - 2. Drains with ball valve and hose connection with cap

## 2.24 ESCUTCHEONS:

- A. Provide chromium steel escutcheons at piping penetrations of walls where exposed public view and required for proper appearance. Provide galvanized steel escutcheons at penetrations of

masonry walls elsewhere. Escutcheons not generally required at drywall penetrations where not exposed to public view.

## 2.25 SLEEVES:

- A. Provide sleeves where pipes pass through floors above grade, roofs, poured-in-place masonry walls, and exterior walls.
- B. Sleeves shall be standard weight steel pipe, except sleeves for concealed piping through floors not in structural members may be 25-gauge galvanized sheet metal.
- C. Seal between piping and sleeve with fire-rated caulk at all penetrations of fire-rated partitions and floors.
- D. Make sleeves through outside walls watertight. Caulk between uninsulated pipe and sleeve.
- E. Size sleeves for insulated pipes to allow full thickness insulation.
- F. Coordinate with the requirements of the Structural Engineer regarding any sleeves/penetrations through any structural members. Submit proposed penetrations for Structural Engineer review and approval prior to the Shop Drawing Submittal.

## 2.26 VIBRATION ISOLATION

- A. Piping Isolation for Noise Control
  - 1. Piping isolation for noise control: Holdrite, Acousto-Plumb System isolators, holders and guides
  - 2. Isolate water piping from structure with Acousto-Plumb System isolators, holders and guides for 1-inch and smaller.
  - 3. Isolate waste pipes and water pipes larger than 1-inch with Stoneman Trisolator System components
  - 4. Do not allow the piping, connectors and valves to directly touch the structure, studs, gypsum board, or other pipes.
  - 5. Provide isolation for noise control at all riser clamps: Holdrite

## 2.27 INSULATION

- A. Certainteed, Owens Corning, Manville, Knauf or equal
- B. Insulation shall:
  - 1. Meet mold, humidity, and erosion resistance requirements of CMC Standard 6-1
  - 2. Have flame spread not more than 25 and smoke density of not more than 50 when tested as a composite installation per CMC 604.3
- C. Exposed insulation: Insulation exposed to weather shall be protected by a smooth or corrugated aluminum jacket or colored plastic jacket approved for outdoor installation, minimum 0.016 inch thick, secured 3" on center, overlapped at joints and sealed watertight.
- D. Piping:
  - 1. Provide insulation inserts at all pipe supports or pipe hangers for any plumbing piping being insulated (no exceptions)
  - 2. Domestic hot water and Tepid water.
  - 3. Condensate drain piping
  - 4. Fiberglass molded pipe insulation with all service jackets.

5. Insulation inserts required for all pipe sizes
6. Thickness for hot water piping shall be per Title 24 requirements
7. Fittings:
  - a. Hot Water Piping: Fittings on pipe over 1/2" shall be insulated with fiberglass and finished with one piece PVC fitting cover (Zeston). Valves, flanges and irregular surfaces two inches and over shall be insulated with over sized pipe covering with ASJ jacket. Exposed ends shall be finished with four ounce canvas jacket saturated in Arabol.
    - 1) Moisture barrier adhered to inside face
    - 2) Longitudinal seams on bottom
  - b. Secure to insulation with aluminum or stainless steel bands

### **PART 3 EXECUTION**

#### **3.01 PROTECTION OF WORK DURING CONSTRUCTION**

- A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.
- B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage and deterioration during construction. Cover motors and other moving machinery to protect from dirt and water during construction.
- C. Material, Equipment or Apparatus:
  1. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
  2. Remove damaged material, equipment or apparatus from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.
  3. Porous materials, such as pipe insulation, shall be protected from weather. If such material becomes wet during construction, it shall be removed and replaced at no cost to Owner; drying is not sufficient due to possible microbial contamination.

#### **3.02 INSTALLATION AND WORKMANSHIP**

- A. All equipment and material shall be installed in a neat and workmanlike manner.
- B. On closed systems, supplement inhibitor if system is fully or partially drained.
- C. Repair all damaged or temporarily removed walls, roofs, roofing, equipment, etc.
- D. Follow manufacturer's installation instructions and recommendations.
- E. All equipment must be anchored to the building. All hung equipment shall incorporate vibration isolation.

#### **3.03 PIPING**

- A. All exposed piping shall be run neatly parallel or perpendicular to building structural grid.
- B. Routing of pipe shall be in a neat manner to work with the architectural and structural elements of the Building and the requirements of the Architect. Any pipe routes at exposed ceiling areas are subject to review and approval by the Architect.

- C. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak resistant piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.
- D. Wherever possible, piping shall be run in beam bays before offsetting to below a beam.
- E. Verify all invert elevations and pitched lines before starting work.
- F. Provide insulating couplings or dielectric unions at all connections of ferrous piping to non-ferrous piping.

### 3.04 VALVES

- A. For valves in multiple parallel runs of piping, provide 4" clearance between valve handle and adjacent pipe, or insulation. Install valve handles in horizontal position between pipes. Do not install valve handles on top of pipe.
- B. Install valves in accordance with manufacturer's written installation instructions
- C. Provide valves as shown on drawings
- D. Provide all valves (except control valves), strainers, and check valves of same size as the pipes in which they are installed unless otherwise indicated
- E. Pressure rating of valves same as piping in which installed
- F. Install valves with stems upright or horizontal, not inverted
- G. Install valves with cast directional arrows in direction of flow
- H. Support line valves at the valve in addition to regularly spaced pipe supports shown and specified.
- I. Provide blow-down ball valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, etc. of same size as strainer blow-off connection
- J. Provide drain valves at main shut-off valves, low points of piping and apparatus
- K. Locate wheel handles to clear obstructions with hand
- L. Install valves only in accessible locations
- M. Wherever possible, install valves accessible from floor level. Provide guided chain operators on valves over 7 feet above floor in equipment areas. Extend chains to within 6 feet 6 inches of floor.
- N. Locate equipment shut-off valves to be accessible without climbing over equipment
- O. Provide operating handles for all valves and cocks without integral operators, unless otherwise noted. Provide adequate clearance for easy operation
- P. Provide open-ended line valves with plugs or blind flanges

### 3.05 PIPE INSULATION SCHEDULE

- A. Insulation Application Types
  - 1. Type P-2:
    - a. Molded Fiberglass

- b. All-service jacket
- c. Provide calcium silicate inserts for all pipe sizes
- 2. Type P-3: Flexible elastomeric insulation

B. Application Schedule

<u>Service</u>	<u>Type</u>	<u>Size</u>	<u>Thickness</u>
Domestic Hot Water and Tepid water  (All piping from water heater to each point of use)	P-2	All	Per Title 24 for circulated systems minimum.
Condensate Drains	P-3	All	1 inch
Domestic Cold, and Non-Potable Water Within the Building	P-2	All	1/2 inch
Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities	P-3	All	1/2 inch
Rainwater Leader, Overflow Drain and Storm Drain Within the Building	P-2	All	1/2 inch

- C. Non-insulated piping and equipment
  - 1. Vent, overflow, drain and relief, except as noted otherwise

**3.06 PIPE INSULATION INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions
- B. Coordinate with work of other trades
- C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness
- D. Install insulation where it cannot become wet. If insulation becomes wet, remove and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.
- E. Insulate all piping, valves, fittings, flanges and accessories
- F. Provide calcium silicate inserts for all pipe sizes and all types of supports
- G. Insulate fittings, joints and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fitting covers or radial mitered segments of pipe insulation. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage. Enclose within two-piece no. 15 gauge aluminum covers fastened with cadmium-plated bolts and nuts.

- H. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping
- I. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations
- J. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation.
- K. Elastomeric Tubing
  - 1. Provide insulation
  - 2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
  - 3. Apply additional jacket as specified
- L. Perform work at ambient and equipment temperatures as recommended by adhesive manufacture
- M. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost

### 3.07 VIBRATION ISOLATION

- A. Installation:
  - 1. Install isolators and seismic restraints in accordance with manufacturer's written instructions
  - 2. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified:
    - a. The Plumbing Sub-contractor shall not install any equipment, piping which makes rigid contact with the "building" unless permitted in this Specification. Building includes, but is not limited to, slabs, beams, columns, studs and walls
    - b. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.
- B. Piping Isolation:
  - 1. Wall and Floor Penetrations: Do not allow the piping, connectors and valves to directly touch the structure, studs, gypsum board, or other pipes. All piping to be isolated shall freely pass through walls and floors without rigid contacts or connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 0.75 inches to 1.25 inches clearance around the pipe or duct outside surfaces:

### 3.08 CLEANING

- A. During construction:
  - 1. Keep openings in piping closed to prevent entrance of foreign matter.
  - 2. Clean pipe, fittings and valves internally.
- B. Clean all drains, and tanks, of dirt and debris.
- C. Remove shipping paper from cleanout covers and drain strainers and polish.
- D. Remove and clean out all dirt and debris from pipe spaces, including all wire, and blocking.

- E. All equipment and materials furnished by this Section shall be completely dust and paint free, clean and rust free and freshly painted or polished when the final inspection is made.
- F. Thoroughly clean and flush interior and exterior of all piping systems (wet systems, and drainage systems) of any nature of all pipe contaminates such as cuttings, fillings, grease, solder, flux and welding residue.
- G. All exposed materials at non dropped ceiling conditions shall be de-greased and paint-ready. Contractor shall verify where non dropped ceiling conditions exist (base bid and/or alternates) with the Architect.

### 3.09 STERILIZATION

- A. Aquatect or equal
- B. At the completion of testing and adjusting, and before domestic water system are put into use, they shall be sterilized. Perform the entire disinfection procedure under the supervision of the Authority Having Jurisdiction. Until sterilization of the domestic and reclaimed water system has been completed, all water outlets shall have signs posted at their locations stating the water system has not been sterilized and shall not be used for human consumption. The Plumbing Contractor shall furnish and install all valves, outlets, and devices required by the sterilization sub-contractor to complete the sterilization work.

### 3.10 EQUIPMENT, VALVE AND PIPING IDENTIFICATION

- A. Equipment:
  - 1. Shall be per the District Standards.
  - 2. All plumbing equipment shall be identified by nameplates securely fastened in a clearly visible location to the equipment housing or frame. Nameplates shall include the equipment design plan mark and brief description of the area or system served, such as: "Electric Water Heater – Serves Floors Basement through Level 2". Nameplates shall be 2-1/2" x 3/4" minimum, either 1/16" thick Bakelite with engraved white core letters and beveled edge, or aluminum with black enameled background and etched or engraved natural aluminum lettering
  - 3. Manufacturer's nameplate shall be clean and legible and installed in a clearly visible location.
- B. Valves
  - 1. Shall be per the District Standards.
- C. Piping:
  - 1. Shall be per the District Standards.
  - 2. Identify piping with symbol identification, direction of flow arrows and specific pressure zones, complying with ANSI A 13.1 color standards and District Standards.
  - 3. Identify piping at approximately 25' centers where unconcealed. Concealed piping above inaccessible ceilings shall be identified at each access panel. Concealed piping above accessible ceilings shall be identified within 10 feet of each wall penetration (both sides of walls).
  - 4. Where capped piping is provided for future connections, provide legible and durable metal tags indicating symbol identification.
  - 5. Printed labels with colored background and attaching strap: Seton, W. Brady, or equal.
  - 6. Apply in accordance with manufacturer's instructions

### 3.11 LEAKAGE TESTING

- A. Before conducting tests, valve-off or disconnect any equipment and apparatus which may be damaged by the test pressures higher than normal working pressures. All testing shall be witnessed by the Authority Having Jurisdiction.
- B. Sanitary Soil, Waste, and Vent Piping: Hydrostatically test and prove tight, to provide a minimum 10 foot head of water, and in accordance with the governing plumbing code.
- C. Rainwater Leader, Overflow Drain Piping: Test and prove tight in accordance with the plumbing code.
- D. Domestic Cold Water Piping: Test and prove tight under 200 PSI hydrostatic pressure.
- E. Sanitary Sewage Pumps and Storm Drain Pumps Pump Discharge Piping: Test and prove tight under 125 PSI hydrostatic pressure.
- F. Trap Primer Piping: Test and prove tight under 50 PSI hydrostatic pressure.
- G. Unless otherwise noted above, apply all tests for minimum period of (4) hours, and until tests are complete, in the opinion of the inspecting authority.
- H. Work may be tested in sections, if necessary, for convenience. In this case, test of first section shall include all connections between previously tested sections and section under test.
- I. Furnish all labor and all other utilities required to make tests.

### 3.12 TESTING AND ADJUSTING

- A. Adjust all valves and outlets.
- B. Demonstrate correct operation of sanitary sewer pumps.
- C. Demonstrate correct operation of storm drain pumps.
- D. Demonstrate correct operation of water heating equipment.
- E. Demonstrate correct operation of trap primers
- F. Demonstrate correct operation of backflow prevention devices
- G. Assist in the testing and adjusting of equipment furnished and installed under other Divisions, but served and connected under this section

### 3.13 TRAINING

- A. Training Sessions
  - 1. Engage a qualified trade or manufacturer's representative to provide the instructions on the water heater system equipment. The trainer may be a factory-authorized service representative, installing contractor or start-up technician to train Owner's maintenance personnel on:
    - a. Procedures for starting and stopping and troubleshooting each water heater
    - b. Procedures and schedules for maintaining and servicing each water heater
    - c. Organization and content of water heaters Operations & Maintenance Manuals
    - d. Procedures for operation and trouble shooting of thermostatic mixing valve assembly
    - e. Organization and content of thermostatic mixing valve assembly Operations & Maintenance Manuals

- f. Start training with classroom sessions followed by hands-on training on each piece of equipment.
- 2. Start training with classroom sessions followed by hand-on training on each piece of equipment
  - a. Classroom Training shall use slides, drawings and O & M manuals to cover as a minimum:
    - 1) The equipment's specific location in the building and in the mechanical system
    - 2) Purpose and function of the equipment
    - 3) A brief working knowledge of the operating theory of the equipment
    - 4) Submittal drawings, catalog data, and O&M manual content and organization
    - 5) Available parts lists, including recommendations regarding parts that should be readily available and stored on site
    - 6) Local representatives for service, parts, and repair, including contact information
    - 7) Startup, shutdown, normal operation, and emergency operating procedures
    - 8) Safety and emergency procedures including proper precautions when around equipment
    - 9) Daily, weekly, monthly, quarterly, semiannual and annual routine preventative maintenance requirements and procedures
    - 10) Required equipment exercise procedures and intervals
    - 11) Normal and major repair procedures
    - 12) Equipment inspection and troubleshooting procedures including the use of applicable test instruments
    - 13) Routine and long-term calibration procedures
  - b. Hands-on training shall be on-site and use O&M manuals as a guide to cover as a minimum:
    - 1) Location of equipment
    - 2) Piping connections and flow directions
    - 3) Valves, including control and flow balancing valves, and their purpose
    - 4) Instrumentation and controls, and interpretation of displayed information
    - 5) Demonstrate startup and shutdown procedures
    - 6) Identify location of all related equipment power disconnect switches, fuses and circuit breakers
    - 7) Demonstrate required equipment exercise procedures
    - 8) Demonstrate and perform standard operating procedures and checks
    - 9) Demonstrate routine preventative maintenance activities including mechanical and electrical adjustments and calibration
    - 10) Demonstrate routine disassembly and assembly of equipment if applicable
    - 11) Identify and review safety items and perform safety procedures
- B. Training Duration and Schedule
  - 1. Total training shall be 4 hours for all the sanitary sewer pumps and storm drain pumps training

**END OF SECTION**

**SECTION 230000**

**HEATING VENTILATING & AIR CONDITIONING**

**PART 1 GENERAL**

**1.01 DESCRIPTION & SCOPE**

- A. Work included: Engineering, materials, equipment, fabrication, installation, starting, testing and commissioning of heating, ventilating and air conditioning systems
- B. Project Scope Summary
  - 1. The project consists of retrofitting the existing central utility plant at the Laney College Campus in Oakland, CA.
  - 2. The scope of work for this bid includes the chilled and hot water plant equipment located in Building E that provides heating and cooling to all buildings on campus. In addition, the existing cooling towers will be demolished and relocated to a new enclosure south of Building F.
- C. Excluded work
  - 1. Building Automation Systems
    - a. BAS will be bid after the HVAC design is further developed so that the scope is better defined.
    - b. The BAS will be bid as Division 25 and may or may not be a subcontractor to Division 23. The Division 25 budget estimate is \$500,000 and **should not** be included in the pricing for scope of work under Division 23.
  - 2. See Paragraph 1.01E for scope of work coordination.
- D. Design/Build Approach
  - 1. The work for this project will be built using a “design/build” approach. The design/build mechanical contractor (“Contractor”) and Taylor Engineering (“Engineer”) shall share design responsibilities as indicated herein.
  - 2. The table below indicates engineering responsibility assignments for the Contractor and the Engineer.

<b>Item</b>	<b>Contractor</b>	<b>Engineer</b>
Engineer-of-Record	P	–
Mechanical system program requirements	R	P
Equipment sizing	P	R
Primary equipment selection (see Paragraph 1.02B)	P	P
Other equipment selection	P	S
Hydronic distribution systems conceptual design	R	P
Hydronic distribution systems	P	R
Air distribution systems conceptual design	R	P
Air distribution systems	P	R
Vibration and noise control	P	R
Control systems	N	P
Construction details (see note below)	P	R
Seismic restraints	P	R

Item	Contractor	Engineer
Completion of permit drawings	P	R
Title 24 HVAC Compliance Documentation	P	R
Project construction management	P	N
Construction and all field work	P	R
Construction quality control	P	N
Start-up & TAB	P	R
Commissioning	S	S

3. Explanatory notes

- a. Primary (P) responsibility shall mean making all decisions and taking engineer/contractor-of-record responsibility for the item.
- b. Secondary (S) responsibility shall mean taking an active role assisting the party with primary responsibility for the item.
- c. Review (R) shall mean that the party shall review and comment on the work done by the party with primary responsibility for the item.
- d. No (N) responsibility shall mean the party will have no role with regard to the item.
- e. "Construction details" includes wall, roof, and floor penetration details, piping, ductwork, and equipment details and supports, vibration isolation details, housekeeping pad layouts and dimensioning, etc.
- f. Commissioning will be overseen by a 3<sup>rd</sup> party commissioning provider retained by the Owner.

4. The Contractor shall be the engineer-of-record as well as the contractor of record and responsible for all required work.

E. Scope of Work Coordination

1. Coordination with other Trades: The following table is intended to assist the Contractors in coordinating the scope of work between Division 23 HVAC (indicated as 23 in table), Division 25 Building Automation Systems (indicated as 25), and other Divisions as indicated. However, the General Contractor is ultimately responsible for coordination among his subcontractors regardless of what is listed in this Section.

INTERFACE / RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
<b>A. FIRE SPRINKLER SYSTEM</b>					
1. Flow switches	21	21	26	26	
2. Valve monitors	21	21	26	26	
3. Post indicating valves	21	21	26	26	

INTERFACE / RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
<b>B. FIRE &amp; LIFE SAFETY SYSTEMS</b>					
1. Fire alarm controls	26	26	26	26	
2. Duct mounted & in-duct mounted smoke detectors	26	23	26	26	
3. Other smoke detectors	26	26	26	26	
4. Smoke control interlocks to HVAC fans	26	26	26	26	2
5. Smoke dampers with electric actuators	23	23	26	26	
6. Smoke damper end switches	23	23	26	26	
<b>C. MECHANICAL EQUIPMENT</b>					
1. Unitary mechanical equipment	23	23	26	25	3
2. Chillers	23	23	26	25	3, 7
3. Air compressors	23	23	26	25	3, 8
4. Variable speed drives, field mounted	23	26	26	25	
5. Motors, 3 phase	23	23	26	–	
6. Motor starters, 3 phase	26	26	26	25	4
7. Motors, 1 phase	23	23	26	26	5, 6
8. Other powered equipment	23	23	26	25	
9. Disconnects/circuit breakers	26/23	26/23	26	–	9
10. Refrigerant leak detector	25	25	26	25	10
11. Cooling tower vibration switch	23	23	–	25	
12. Cooling tower water treatment system	23	23	26	25	11
<b>D. BUILDING AUTOMATION SYSTEM (BAS)</b>					
1. Central control workstations & servers	25	25	26	25	
2. Control system network backbone	25	25	25	25	
3. Line voltage control devices to 120V motors	25	26	26	26	6
4. Control panels	25	25	26/25	25	12
5. Control devices	25	25	25	25	
<b>E. ELECTRICAL SYSTEMS</b>					
1. Lighting Control BACnet gateway	–	–	–	–	
2. Lighting relay panels and low voltage switches	26	26	26	26	
3. Lighting occupancy sensors	–	–	–	–	
4. Power monitoring sensors and gateway	26	26	26	26/25	13
<b>F. PLUMBING SYSTEMS</b>					
1. Air compressors	23	23	26	23/25	
2. Compressed air dryer, filter, PRV	23	23	26	23/25	
3. Condensate drains including traps, primers	22	22	–	–	14
4. Condensate pumps	23	23	23/26	–	15

INTERFACE / RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
5. Make-up water to hot/chilled/condenser water including backflow prevention	22	22	-	-	16
6. Natural gas connections, pressure reducing station, gages	22	22	-	-	17
7. Gas and water flow meters	25	22	25	25	
8. Pipe gauges, thermometers, test plugs	22	22	-	-	
9. Self-powered valves, pressure relief valves, liquid level controllers, etc.	22	22	-	-	
10. Sensor wells, meters and other pipe-mounted control devices	25	22	25	25	
11. Floor drains	22	22	-	-	18
<b>G. HVAC HYDRONIC SYSTEMS</b>					
1. Pipe gauges, thermometers, test plugs	23	23	-	-	
2. Self-powered valves, refrigerant powered head pressure control valves, pressure relief valves, liquid level controllers, etc.	23	23	-	-	
3. Relief valve vent piping, equipment drain piping, etc. from equipment to floor drains/sinks	23	23	-	-	
4. Automatic isolation and control valves	25	23	25	25	
5. Sensor wells, meters and other pipe-mounted control devices	25	23	25	25	
6. Underground piping	33	33	-	-	19
<b>H. HVAC SHEET METAL</b>					
1. Duct mounted sensors	25	23	25	25	
2. Filter gauges	25	25	-	-	
3. Control dampers	23	23	-	-	20
4. Control damper actuators	25	25	25	25	20, 21
<b>I. MISCELLANEOUS</b>					
1. Demolition and salvage	2	2	-	-	22
2. Trenching, backfilling, boring, soil compaction, saw-cutting, patching and paving for underground piping	31	31	-	-	
3. Utilities beyond building interior wall line	33	33	-	-	
4. Roofing, including cant strips and counterflashing at the sides of roof curbs	7	7	-	-	
5. Thermal and acoustical insulation in and on partitions and ceilings	7	7	-	-	23
6. Undercutting of doors and door louvers	8	8			

INTERFACE / RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
7. Louvers	8	8	-	-	
8. Concrete housekeeping pads, piers, pedestals and inertia base fill etc. for equipment.	3	3	-	-	24
9. Equipment, ductwork, and piping steel supports and frames	23	23	-	-	
10. Grates and railings protecting mechanical shaft and other floor openings	5	5	-	-	
11. Painting	9/23	9/23	-	-	25
12. Coring or cutting existing wall and floor openings for ductwork and piping	23	23	-	-	
13. Fire-stopping around pipe and duct penetrations in floors and walls	23	23	-	-	
14. Fire rated enclosures where shown around ducts	9	9			
15. Framing of walls and ceilings to accept air outlets, fire dampers, etc.	9	9	-	-	26
16. Ceiling and wall access doors and panels	8	8	-	-	27
17. Elevator shaft vents	-	-	-	-	
18. Architectural shafts and plenum walls	9	9	-	-	28
<b>NUMBERED REMARKS:</b>					
1. Wiring includes raceway, fittings, wire, boxes and related items, all voltages.					
2. Wiring and controls to start and stop fans based on smoke detector status and smoke control logic specified under Division 26 Electrical.					
3. Factory installed starters and variable speed drives are specified under Division 23 HVAC. Prewired control panel is specified under Division 23 HVAC; single point power connection (unless otherwise noted on drawings) specified by Division 23 HVAC.					
4. Applies to motors that are not covered by note 3. Integral starter control devices such as HOA switches, 120V control transformers and time delay relays (from high to low speed) for two speed motors specified under Division 26 Electrical.					
5. Single phase 120V motors with integral motor overload protection specified under Division 23 HVAC.					
6. Line voltage control device such as thermostat or switch specified under Division 25 BAS; wiring and conduit between control device and motor specified under Division 26 Electrical.					
7. Factory installed and wired chilled and condenser water flow switches are specified under Division 23 HVAC; no work is required under Division 25 BAS. Bi-directional (read/write) factory installed BACnet gateway between the BAS and chiller control panel specified with chiller under Division 23 HVAC; control wiring specified under Division 25 BAS. Chiller vendor to provide all necessary technical assistance to Division 25 BAS Contractor in mapping across chiller points to the BAS.					
8. Control air dryers and PRV stations for any pneumatically actuated control equipment specified under Division 25 BAS.					

INTERFACE / RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
<p>9. Disconnects or circuit breakers are specified under Division 23 HVAC where specifically called for in equipment schedules or specifications to be factory installed with equipment. Otherwise all disconnects are specified under Division 26 Electrical.</p> <p>10. Emergency override switches, status lights and other refrigerant machinery room controls as required by CMC are specified under Division 25 BAS.</p> <p>11. TDS controller, bleed valve, injector pump, make-up water flow meter, and all other water treatment system controls are specified under Division 23 HVAC. Field wiring of all components is specified under Division 25 BAS.</p> <p>12. 120V power to BAS control panels is specified under Division 26 for the panels shown on Drawings. Power to all other control panels that may be required is specified under Division 25 BAS, coordinated with Division 26 contractor for available circuits.</p> <p>13. Power measuring sensors, installation and wiring to a single central controller with BACnet/IP interface specified under Division 26 Electrical. BACnet/IP gateway and network connection from gateway to BAS specified under Division 25 BAS. Power monitoring control vendor to provide all necessary technical assistance to Division 25 BAS Contractor in mapping across power monitoring control points to the BAS.</p> <p>14. Condensate piping from condensate pans to the sewer system including trap and final connections is specified under Division 22 Plumbing. Piping from auxiliary drain pans where provided at fan-coils is specified under Division 23 HVAC.</p> <p>15. Condensate pumps scheduled to be an accessory to the cooling unit are powered off the cooling unit; no Division 26 work is required. Power for condensate pumps scheduled under Remarks as field installed is specified under Division 26.</p> <p>16. Domestic make-up water, including shut-off valve, backflow prevention, rough-in and final connection to hot water, chilled water, condenser water and any other HVAC systems requiring make-up water is specified under Division 22 Plumbing. Pressure reducing valves with bypass valve and shut-off valves at each closed-system make-up water connection are specified under Division 23 HVAC.</p> <p>17. Pressure reducing valves to deliver gas at the pressure required by mechanical equipment, including final connections and shut-off cock, is specified under Division 22 Plumbing. All other gas control and regulating devices provided under the Section providing the gas-fired equipment. Venting of gas regulating devices and other equipment gas-train devices where required is specified under Division 22 Plumbing.</p> <p>18. Floor drains and sumps shall be provided under Division 22 Plumbing adjacent to each pair of chillers, towers, boilers, water treatment system, etc. Where drains are located in negative air plenums, trap primers are required.</p> <p>19. Underground piping shall terminate just inside building envelope and include seals at wall/floor penetration. Piping from that point of connection inside the building is specified under Division 23 HVAC.</p> <p>20. Duct access doors required for access to control devices where required specified under Division 23 HVAC.</p> <p>21. Actuators for motorized dampers supplied with fans or hoods where scheduled on HVAC drawings are specified under Division 23 HVAC, mounted but not wired.</p> <p>22. Division 23 HVAC Contractor shall identify all mechanical related equipment and appurtenances to be retained, if applicable. Demolition work is specified under Division 2 Existing Conditions</p>					

INTERFACE / RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
<p>23. Wall, roof, ceiling, and floor thermal insulation identified on architectural drawings is specified under Division 7. Any acoustical insulation required for HVAC systems, whether mounted on or in ducts or on walls (including mechanical room walls), shafts, roofs, ceilings, or floors, shall be provided by the HVAC Contractor.</p> <p>24. Shop drawings showing dimensions of all curbs, bases, etc. specified under Division 23 HVAC.</p> <p>25. Painting of exposed piping, HVAC equipment, etc. per Paragraph 3.10 specified under Division 23 HVAC. All other painting specified under Division 9.</p> <p>26. Additional T-bar or spline and cut ceiling tile as required to accept air outlets is specified under Division 9.</p> <p>27. Dimensioning of access doors to mechanical equipment and coordination with Architect and Division 8 specified under Division 23. It is the responsibility of the HVAC Contractor to review architectural drawings to be sure that all access doors required for HVAC systems are properly located and dimensioned. Those that are not identified by the HVAC Contractor prior to ceiling/drywall bids shall be the responsibility of the HVAC Contractor.</p> <p>28. The HVAC Contractor shall identify all architectural shafts and plenum walls and their construction and sealing requirements to the architect for inclusion in architectural contract documents. It is the responsibility of the HVAC Contractor to review architectural drawings to be sure that all architectural shafts, plenums, etc. required for HVAC systems are properly located and dimensioned. Such items not identified by the HVAC Contractor prior to Division 9 bids shall be the responsibility of the HVAC Contractor.</p>					

**1.02 BID INSTRUCTIONS**

- A. This specification is intended to
  - 1. Specify system performance/design criteria. The HVAC Contractor’s proposal shall not deviate from these Design Criteria without written approval. Questions regarding the appropriateness or correctness of requirements shall be directed to the General Contractor in writing prior to bid. Any changes in design or performance criteria will be disseminated to all bidders.
  - 2. Establish the desired level of quality, including suggested design options that the Engineer feels will meet the performance requirements and design intent. HVAC Contractors’ proposals may be based on the suggested approaches or on any other design of similar quality. If there is a question as to the appropriateness of any alternative system ideas, the HVAC Contractor shall review the proposed design (in the strictest confidence) with Taylor Engineering prior to bid.
- B. Stipulated Pricing for Primary Equipment
  - 1. Primary equipment shall be included in bids using the prices stipulated below. This equipment will be bid after the contractor is selected with final pricing adjusted based on actual price vs. stipulated price adjusted for taxes and contractor markup. See this article for details and rationale: [https://taylorengeers.com/wp-content/uploads/2020/04/ASHRAE\\_Journal\\_-\\_Value-Based\\_HVAC\\_Equipment\\_Selection.pdf](https://taylorengeers.com/wp-content/uploads/2020/04/ASHRAE_Journal_-_Value-Based_HVAC_Equipment_Selection.pdf).
  - 2. All pricing below excludes:

- a. Taxes and fees: Taxes and fees will be applied to the cost of equipment at time of selection. Contractor does not include in bid.
  - b. Storage: Contractor to include cost of storage in bid, as necessary, to meet project schedule requirements.
  - c. Installation: Contractor to include installation cost in bid.
  - d. Contractor overhead & profit: Contractor to include percentage markup that will be applied to equipment. See Paragraph 1.03A.1.
3. Primary Equipment Pricing
- a. Chillers
    - 1) Price: \$575,000
    - 2) Includes the following equipment, materials, and systems:
      - a) CH-1, CH-2
      - b) All scheduled accessories
      - c) Freight to jobsite
      - d) One-year warranty on parts and labor
      - e) Factory startup
      - f) Owner training
  - b. Non-condensing boilers
    - 1) Price: \$230,000
    - 2) Includes the following equipment, materials, and systems:
      - a) B-1, B-2, B-3, B-4
      - b) All scheduled accessories
      - c) Freight to jobsite
  - c. Cooling towers
    - 1) Price: \$160,000
    - 2) Includes the following equipment, materials, and systems:
      - a) CT-1, CT-2
      - b) All scheduled accessories
      - c) Freight to jobsite
- C. Contractor proposals shall include the following
- 1. A narrative of the proposed system design
  - 2. Any exceptions to these specifications
  - 3. Completed bid form
    - a. Design and Construction Price; broken down as follows:
      - 1) Base scope price: The base scope shall include all work described herein including installation of all HVAC equipment, procurement of secondary equipment, piping, duct, and flue connections.
      - 2) Breakout prices: Where breakout prices are requested in bid form, include materials, taxes, freight, installation, and mark-up, as applicable.

- a) Breakout price to procure and install all new chilled water pipe.
    - b) Breakout price to procure and install all new condenser water pipe.
    - c) Breakout price to procure and install all new hot water pipe.
  - b. Additive/deductive alternates: Alternates listed herein must be bid. Additional voluntary alternates are strongly encouraged.
  - c. Unit prices, as specified herein
- D. Contractors shall prepare the following for the interview with the design team (This information may also be provided with proposals, at contractor's option):
- 1. A preliminary schedule or detailed list of equipment showing proposed manufacturers, models, sizes, etc. **for secondary equipment (i.e. all equipment without stipulated pricing).**
  - 2. Sketches or drawings showing the locations and dimensions of major equipment such as chillers, boilers, cooling towers, pumps, etc.
  - 3. Description of plumbing requirements such as make-up water, floor drains, condensate, etc.; use coordination form provided with bid documents.
  - 4. Description of electrical requirements; use coordination form provided with bid documents.
  - 5. Proposed mechanical room requirements if other than what is shown on current architectural and mechanical plans
  - 6. Requirements for concrete and steel work such as equipment bases under cooling towers, chillers, boilers, pumps, etc.
  - 7. Resumes of personnel who will be assigned to the project, including:
    - a. Design Engineer
    - b. Construction Manager
    - c. Field Superintendent
- E. Proposals will be evaluated by the Laney CUP Selection Committee including Taylor Engineering, the Architect, Owner, and Construction Manager based on value, price, space requirements and other architectural impacts, requirements of other trades, and quality and reputation of the proposed project personnel.

### 1.03 MARKUP, ALTERNATES, AND UNIT PRICES

- A. Contractor Markup
  - 1. Total percentage markup on equipment with stipulated pricing per Paragraph 1.02B.
  - 2. Total percentage markup on the Division 25 Building Automation System (designed by the Engineer and to be bid during CD phase), if it is assigned as a subcontractor to Division 23.
- B. Alternates
  - 1. Provide **(3)** year warranty. See Paragraph 1.13D.
  - 2. Provide **1-year maintenance** contract to service chilled and hot water plant. See Paragraph 1.14A.
  - 3. Provide **3-year maintenance** contract to service chilled and hot water plant. See Paragraph 1.14B.
  - 4. Refurbish existing primary chilled water pumps. See Paragraph 1.15C.1.e.2).
  - 5. Provide and pipe one redundant primary chilled water pump. Provide additional VFD to be installed and wired by Division 26. See Paragraph 1.15C.1.e.3).
  - 6. Refurbish existing secondary chilled water pumps. See Paragraph 1.15C.1.f.2).

7. Provide and pipe one redundant secondary chilled water pump. Provide additional VFD to be installed and wired by Division 26. See Paragraph 1.15C.1.f.3).
  8. Provide cooling tower filtration system. See Paragraph 1.15C.1.i.
  9. Provide and pipe one redundant condenser water pump. Provide additional VFD to be installed and wired by Division 26. See Paragraph 1.15C.1.j.3).
  10. Engage testing firm to provide non-destructive testing (ultrasonic thickness testing) to verify condenser water pipe and chilled water pipe thickness meets acceptable limits described in Paragraph 2.17. Keep all chilled and condenser water piping in chiller room that meet acceptable wall thickness limits. See Paragraph 1.15C.1.m.3).
  11. Refurbish existing secondary hot water pumps. See Paragraph 1.15C.2.g.2).
  12. Provide and pipe one redundant secondary hot water pump. See Paragraph 1.15C.2.g.3).
  13. Engage testing firm to provide non-destructive testing (ultrasonic thickness testing) to verify hot water pipe thickness meets acceptable limits described in Paragraph 2.17. Keep all hot water piping in chiller room that meet acceptable wall thickness limits. See Paragraph 1.15C.2.j.3).
  14. Demolish existing boiler flue main and stack. Provide new boiler flue main and stack. See Paragraph 1.15C.2.m.3).
  15. Provide new chiller room exhaust fan. See Paragraph 1.15C.3.a.2).
  16. Boiler and chiller room conditioning. See Paragraph 1.15C.4.a, Paragraph 1.16F and Paragraph 2.06.
  17. Any proposed by HVAC Contractor at his option
- C. Unit prices: Unit prices shall include all equipment, material, labor, design engineering, balancing, start-up and testing costs necessary to provide a complete operational system. Prices may be used to add or deduct items from the scope for 1 year from award of contract. Prices are based on construction during normal design and construction schedule. Prices will be used to determine complete contract amount by multiplying quantity of each item times unit prices; this will be the complete price unless unusual conditions apply or item does not correspond to unit price description.
1. Provide unit price for the procurement and installation of a 2-pipe fan coil unit.

#### 1.04 REFERENCE STANDARDS

- A. Requirements of Regulatory Agencies
1. Nothing in Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules, regulations.
  2. When drawings or Specifications exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.
  3. Applicable codes include the current version of those listed below, in addition to others specified in individual sections
    - a. CBC – California Building Code
    - b. CMC – California Mechanical Code
    - c. City of Oakland Codes, Ordinances, and Code Amendments
    - d. The State of California Codes
  4. If any of above requirements is in conflict with one another, or with Specifications' requirements, the most stringent requirement shall govern. Where codes are silent on an issue, NFPA Standards shall apply.

- B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Section
  - 1. AABC - Associated Air Balance Council
  - 2. ADC - Air Diffuser Balance Council
  - 3. AMCA - Air Moving and Conditioning Association
  - 4. ANSI - American National Standards Institute
  - 5. AHRI - Air Conditioning, Heating and Refrigeration Institute
  - 6. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
  - 7. ASME - American Society of Mechanical Engineers
  - 8. ASTM - American Society for Testing and Materials
  - 9. ETL - Intertek Semko (Formerly Electrical Testing Laboratories)
  - 10. IEEE - Institute of Electrical and Electronic Engineers
  - 11. NEMA - National Electrical Manufacturer's Association
  - 12. NFPA - National Fire Protection Association
  - 13. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
  - 14. UL - Underwriters' Laboratories
- C. Industry standards and manufacturers' recommendations, diagrams or requirements shall be strictly adhered to for installation of materials and equipment.

#### 1.05 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. All items of a given type shall be the products of same manufacturer.
- C. Supply all equipment and accessories new and free from defects.
- D. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.04 of this section with all applicable national, state and local codes.

#### 1.06 DEFINITIONS

- A. Definitions of term used in Division 23 Sections may differ from those given in general and supplementary conditions and take precedence over them.
- B. "Provide": to supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
- C. "Install": to erect, mount and connect complete with related accessories.
- D. "Supply": to purchase, procure, acquire and deliver complete with related accessories.
- E. "Work": labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.
- F. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- G. "Wiring": raceway, fittings, wire, boxes and related items.
- H. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

- I. "Exposed": not installed underground or "concealed" as defined above.
- J. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or specifications.
- K. "Similar" or "equal": of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product, conforming to PART 2 Materials.
- L. "Reviewed," "satisfactory," or "directed": as reviewed, satisfactory, or directed by or to Architect.
- M. "Motor Controllers": manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- N. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

#### **1.07 JOB CONDITIONS**

- A. Examine site related work and surfaces before starting work of any Section.
  - 1. Contractors shall be responsible for any conditions that can be visually observed at jobsite and in unconcealed, accessible areas.
  - 2. Contractor shall not be responsible for any conditions in concealed areas that could not be reasonably anticipated at time of bid. Any additional work caused by these conditions shall be by change order.
- B. Parking and special traffic requirements
  - 1. Contact General Contractor for information and constraints
  - 2. Obtain all City permits and clearances required for hoisting and rigging equipment

#### **1.08 REVIEW OF CONSTRUCTION**

- A. Work may be reviewed at any time by Owner or Owner's representative.
- B. Advise Owner or Owner's representative that work is ready for review at following times
  - 1. Prior to concealment of work in walls and above ceilings
  - 2. When all requirements of Contract have been completed
- C. Do not conceal work without Owner's representative review.
- D. Maintain a set of Specifications and Drawings including all change orders on the job for use by Owner's representatives.

#### **1.09 DESIGN DOCUMENTS**

- A. An employee of the HVAC Contractor shall serve as Engineer-of-Record. (A third party consulting engineer is acceptable only if consultant has significant design/build experience and a record of working with the HVAC Contractor on past projects of this size and complexity.)
- B. The HVAC Contractor/engineer shall maintain a design and detailing schedule consistent with those of the architect and other engineers to produce working drawings and shop drawings in a timely and professional manner, consistent with the project construction schedule.
- C. All HVAC system design documents shall be prepared under the supervision of the Engineer-of-Record.
- D. Calculations
  - 1. Heating and cooling load calculations and equipment selections shall be supervised and reviewed by a registered professional engineer.

2. Provide all heating and cooling load calculations for review by the Owner.
  3. Provide calculations and documentation to demonstrate HVAC systems compliance with prescriptive Title 24 Energy Standards.
- E. Design documents
1. All design drawings shall be created using Revit 2013 or higher as determined by the Architect.
    - a. Detailed clash detection shall occur at the 50% CD issue.
    - b. Final construction drawings shall be Level of Development 300.
  2. Drawings, at a minimum, shall include the following
    - a. Equipment schedules
    - b. Floor plans: Scale to match architectural drawings or larger, minimum 1/8" scale
    - c. Equipment rooms: 1/4" scale
    - d. Riser sections: 1/4" scale
    - e. Piping diagrams
    - f. HVAC Title 24
- F. Dimensioning and detailing. All design drawings shall include the following
1. Duct mains and all rectangular ductwork shall be drawn double line
  2. Top and bottom elevations shall be indicated for all duct mains
  3. Bottom or centerline elevations shall be indicated for all piping mains
  4. Notes, tags, etc. shall be on plans next to designated items; sheet notes shall not be used.
- G. Drawings shall be complete for use as on-going comprehensive service record drawings. Existing systems and equipment shall be shown with dashed lines. Drawings shall include
1. All new and existing equipment
    - a. Tag all equipment
    - b. Schedule all new and existing equipment located in the central utility plant and the cooling tower enclosure
  2. All new and existing ducts and grilles
    - a. Tag all ducts with duct sizes
    - b. Tag all grilles with grille size and airflow
  3. All new and existing piping
    - a. Size all piping

#### **1.10 SUBMITTALS & SHOP DRAWINGS**

- A. Schedule
1. Allow 10 working days for approval, unless Engineer agrees to accelerated schedule.
- B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified in this Section.
- C. Submission Procedure
1. Optional Pre-Submittals. At Contractor's option, electronic submittals indicated below may be submitted unofficially via email directly to the Engineer for review and comment prior to formal submission. Comments provided by the Engineer are not official and may be changed or

additional comments may be provided on the formal submittal. The intent of pre-submittals is to reduce paperwork and review time.

2. Initial submittal
    - a. Each submittal shall have a unique serial number such as "SUBMITTAL 230000-01".
    - b. Submittals may be submitted non-concurrently if required by the schedule.
    - c. Submit one electronic copy of product data in word-searchable format such as Adobe pdf. Provide separate files for each equipment type. Paper copies or scans of paper copies will not be accepted.
    - d. Submittal will be reviewed and comments returned to Contractor.
  3. Resubmission
    - a. Each resubmittal shall have the original unique serial number plus unique revision number such as "SUBMITTAL 230000-01 REVISION 1".
    - b. Make any corrections or change in submittals as required.
    - c. Resubmit for review in electronic format described above until no exceptions are taken.
    - d. The cost of Taylor Engineering's review of submittals after first resubmittal will be borne by Contractor at Taylor Engineering standard billing rates.
  4. Final approval: Once submission is accepted, Contactor shall provide printed and/or electronic copies for coordination with other trades as required by the General Contractor. Taylor Engineering does not require or desire paper copies.
- D. Contents of Submittals
1. HVAC Equipment Submittals
    - a. Manufacturer's name and model number
    - b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to
      - 1) A schedule, for all items of the same type shall be supplied. The schedule shall include the manufacturer, the model, size, specific information that makes that item unique, the service of the item, the system served by the item.
      - 2) Physical Data, as applicable
        - a) Dimensions
        - b) Weight
        - c) Finishes and colors
      - 3) Performance Data, as applicable
        - a) Rated capacities
        - b) Performance curves
        - c) Operating temperature and pressure
      - 4) Electrical and plumbing requirements
      - 5) Flow and wiring diagrams as applicable
      - 6) Description of system operation
    - c. All other pertinent information requested in individual sections
  2. Test, Adjust, and Balance (TAB) Submittal

- a. All test and report forms that will be submitted for the final TAB report
  - b. A written description of the balance procedures
  - c. Submit at least 30 days prior to any TAB work.
- E. Shop Drawings
1. Drawings shall be developed using 3D software such as Revit, CAD-Duct and CAD-Pipe that is compatible with Navisworks.
    - a. All rectangular ductwork
    - b. All round ductwork other than flexible ductwork
    - c. All piping larger than 3/4" inches
    - d. All equipment
    - e. All grilles, registers and diffusers
  2. Provide coordination plans indicating layout of pads, curbs, penetrations, openings, and other items to be provided by other trades.
- F. Operating Instructions & Maintenance Manuals
1. Before requesting acceptance of work, submit word-searchable electronic set for review by Engineer. Use bookmarks for each equipment type.
  2. After review and making corrections noted, furnish word-searchable electronic set on flash drive and two printed and bound sets in heavy three-ring binder. Provide separate tabs for each equipment type.
  3. O&M manual shall include all submittal data submitted herein above, as installed. The intent of this section is that a single document contains all relevant information about each piece of equipment.
  4. In addition to the submittal data, the O&M manual shall also include the following information
    - a. Manufacturer's name, model number, service manual, spare-parts list, and descriptive literature for all components
    - b. Installation instructions
    - c. Maintenance instructions
    - d. Wiring diagrams
    - e. Listing of possible breakdown and repairs
    - f. Instruction for starting, operation and programming
    - g. Detailed and simplified one line, color coded flow and wiring diagram
    - h. Name, address and phone number of contractors equipment suppliers and service agencies
    - i. Guarantee period, including start and end period
    - j. Start up test readings, dated and signed by testing technician
- G. Record Drawings
1. Update design/shop drawings to "as- built" conditions
    - a. Fully incorporate all revisions made by all HVAC crafts in course of work.
    - b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders

- c. Exact location, type, and function of concealed valves, dampers, controllers, piping, air vents and piping drains
  - d. Exact size, elevations, and horizontal location of piping and ducts
  - e. Revise equipment schedules to reflect all substitutions
  - f. Complete for all HVAC systems, both new and existing
- 2. Submit in electronic format per Submittals above for approval.
  - 3. Once approved
    - a. Provide one set of original Revit files on portable media (e.g. CD) including all referenced background models.
    - b. Load pdf of complete set of as-built drawings onto the control system front end computer.
    - c. Provide one full size set of drawings on bond paper.
    - d. Provide pdf set loaded onto 1 flash drive.

### 1.11 COMPLETION REQUIREMENTS

- A. Until the documents required in this section are submitted and approved, the system will not be considered “accepted” and final payment to contractor will not be made.
- B. O&M Manual; see Paragraph 1.10F.
- C. Record Drawings: See Paragraph 1.10G.
- D. Test and Balance reports; see Paragraph 3.14D.
- E. Inspection and permit: Provide one copy of inspection certificates signed and approved by the local code authorities.
- F. Commissioning documentation and forms; see Paragraph 3.15.
- G. Training; see Paragraph 3.15D.
- H. Warranty: Provide written guarantee and warranty documents for all equipment and systems, including the start and end date for each.

### 1.12 SCHEDULE OF WORK

- A. Arrange design and construction work to conform to schedules established by the General Contractor and Architect.
- B. In scheduling, anticipate means of installing equipment through available openings in structure.
- C. Schedule of Work Constraints
  - 1. No system shutdown shall be permitted without the expressed written approval from the Owner’s Representative. The Contractor shall submit requests for each shutdown at least two weeks in advance. The request shall state what system is to be shutdown, what areas will be affected, how long the period will be, and what contingency plan is provided if the work cannot be completed within the specified time.
  - 2. The classrooms adjacent to the chiller and boiler room in Building E will remain in operation during construction. Changes to systems that affect these areas must be minimal in impact and time out-of-service as limited herein during normal business hours which are weekdays from 6am to 6pm.
  - 3. Central Chilled and Hot Water Service During Construction

- a. The campus will remain operational during construction and building will require chilled and hot water service.
  - b. The central utility plant shall provide a minimum of 200 tons of chilled water capacity and 7,200 KBTUH of hot water capacity to buildings connected to the central utility plant throughout the duration of construction during normal business hours.**
  - c. At present, (1) 200 ton chiller is operational and (1) 7,200 KBTUH output boiler is functional.
  - d. Contractor may use a combination of existing and temporary equipment to provide service during construction.
4. Other Limitations
- a. The chiller plant may be shut down as follows:
    - 1) During normal business hours:
      - a) For periods not exceeding 1 hour
      - b) When the outdoor air temperature is less than 60°F
    - 2) Anytime during non-business hours
  - b. The boiler plant may be shut down as follows:
    - 1) During normal business hours:
      - a) For periods not exceeding 2 hours after 10am
      - b) When the outdoor air temperature is greater than 70°F
    - 2) Anytime during non-business hours
  - c. Domestic water systems shall be maintained fully functional during normal business hours.
5. Include any charges, including overtime wages, required to perform work in phases and to minimize downtime of operating areas.
- D. Schedule test, balance, and acceptance testing of mechanical systems
- 1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
- E. Schedule shall allow several days after installation of all furnishings but prior to occupancy for indoor air quality purging of construction area. See Paragraph 3.12.

### 1.13 GUARANTEE

- A. The HVAC Contractor shall guarantee the following
  - 1. All new materials, new equipment, apparatus and workmanship shall be free of defective materials and faulty workmanship.
  - 2. All equipment and material will produce the results specified.
  - 3. All systems have been fully tested, adjusted, balanced, and commissioned.
- B. The HVAC Contractor shall furnish written guarantee to replace all defective work, materials, and services furnished under this Section, at no additional cost to the Owner, for the warranty period.
- C. The warranty period shall be one (1) year from date of filing of Notice of Completion or beneficial system usage, whichever comes first.

- D. ALTERNATE 1 Warranty period shall be **(3)** years from date of filing of Notice of Completion or beneficial system usage, whichever comes first.
- E. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the guarantees or relieving responsibility during the guarantee period.
- F. The warranty shall not include
  - 1. Standard maintenance items
  - 2. Repairs or replacement of equipment damaged as a result of misuse, abuse, or lack of proper maintenance.
  - 3. Existing equipment and materials not provided by this contract.

#### 1.14 ONGOING MAINTENANCE SERVICE

- A. ALTERNATE 2 Provide **1-year maintenance** contract to service chilled and hot water plant including:
  - 1. Quarterly maintenance as described by equipment operation manuals for the following equipment:
    - a. Non-condensing boilers
    - b. Pumps
    - c. Air compressor and dryer
    - d. Cooling towers
    - e. Condenser water treatment
  - 2. Annual service for non-condensing boilers as described by equipment operation manual
  - 3. An allowance for 10 hours of additional service per quarter performed by a journeyman.
- B. ALTERNATE 3 Provide **3-year maintenance** contract to service chilled and hot water plant including:
  - 1. Quarterly maintenance as described by equipment operation manuals for the following equipment:
    - a. Non-condensing boilers
    - b. Pumps
    - c. Air compressor and dryer
    - d. Cooling towers
    - e. Condenser water treatment
  - 2. Annual service for non-condensing boilers as described by equipment operation manual
  - 3. An allowance for 10 hours of additional service per quarter performed by a journeyman.

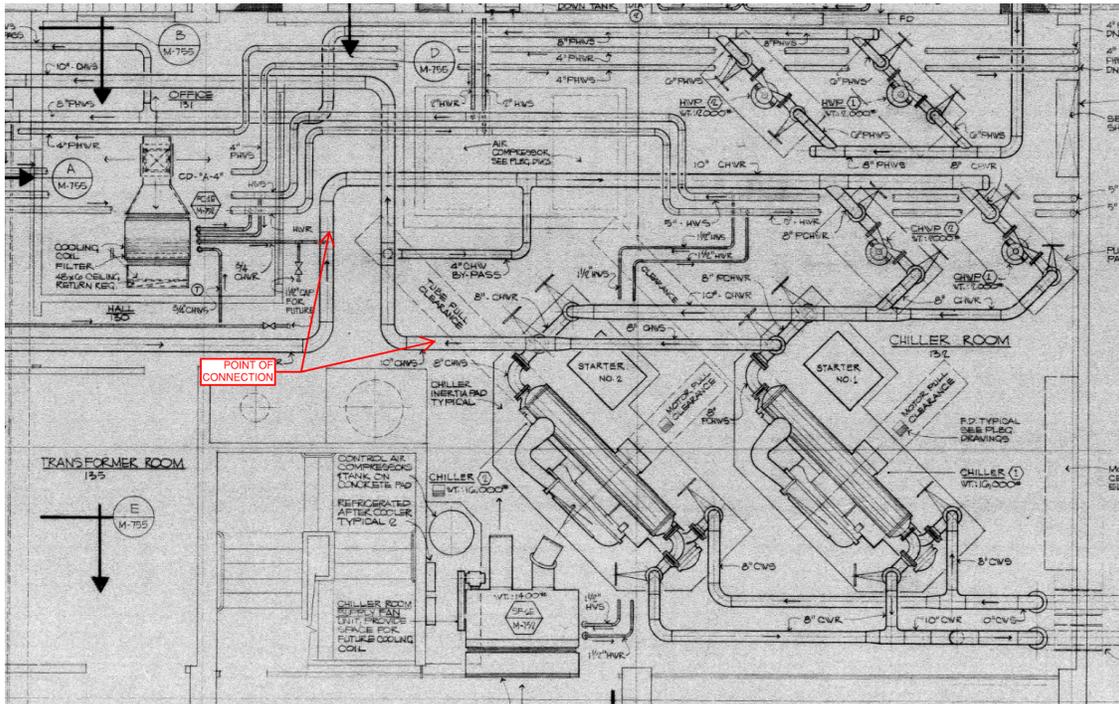
#### 1.15 SYSTEM DESIGN

- A. General
  - 1. The HVAC system shall be selected and designed by the contractor to provide the specified performance requirements in the most life cycle cost optimum fashion. Suggested design concepts are listed in this section. They may be used by the contractor, or an alternative approach of similar or better quality and performance may be selected. When there is doubt about the acceptability of an alternative design, the HVAC Contractor shall seek approval from the Engineer during the bid period. Any inquiries other than those regarding scope will be kept confidential.
  - 2. The HVAC Equipment Coordination Schedule provided with the bid documents indicates preliminary equipment sizes for the purpose of coordinating with other trades.

3. **Laney College intends to convert the central plant to all-electric heating in the future (not part of this scope of work). The conversion will require additional, future equipment. Space in the chiller and boiler room shall be maintained clear as indicated on Drawing M2.01. Two alternatives for future conversion to all-electric heating are shown on drawings M2.02, M5.03, and M5.04. These drawings are for reference only. Conversion to all-electric heating is not contained in the scope of this work.**
- B. Architectural bid drawings
1. Drawings show the clear space required to accommodate future equipment in Building E when the central utility plant is converted to all-electric operation. The HVAC Contractor is not required to use this exact clear space – space may be relocated as required by the proposed design – provided there is a cost or performance benefit and the square footage of the clear area can accommodate the same future equipment. But the review team will look favorably upon designs that require as little revision to architectural and structural plans as possible.
  2. Cooling tower enclosure footprint: **Cooling tower enclosure geometry including the total depth as shown on drawings shall be considered a design constraint.** Designs that require changes to same shall be bid as alternates only. The cooling tower enclosure may be smaller than the footprint shown on architectural drawings provided that the necessary clearances for maintenance and proper airflow are maintained.
- C. Suggested HVAC systems: These systems indicate the desired level of quality but the HVAC Contractor is not limited to them.
1. Central Cooling Plant
    - a. Chilled water plant capacity shall be designed for a 50% increase in current capacity.
    - b. Install a water-cooled chilled water plant with primary-secondary distribution. Both primary and secondary loops shall be variable speed, variable flow.
    - c. Maintain minimum clear space requirements for *future* equipment to be installed when transitioning to an all-electric plant. See Drawing M2.01.
    - d. Chillers
      - 1) Demolish existing three chillers. Refrigerant shall be recovered prior to demolition and shall become the property of the Contractor to be recycled or otherwise disposed of in a lawful manner.
      - 2) Provide and install new chillers in accordance with the following:
        - a) 900 tons total capacity
        - b) Variable speed
        - c) Minimum two, equally sized
        - d) Evaporators and condensers are shown as 3-pass and piped in parallel. See Drawing M5.01. Evaporator and condenser construction and piping arrangement allow the chillers to be used in heat recovery mode in the future. Chillers are not required to be 3-pass provided they are able to produce a minimum condenser water return temperature of 125°F when operating in heat recovery.
        - e) Chillers shall be located where all code required and manufacturer recommended clearances are maintained
        - f) Relocate piping, conduits, ducts etc. as required to remove old equipment and install new equipment
        - g) See Paragraph 1.16A for design temperatures

- 3) Chillers will be selected in conjunction with the Contractor, Engineer, and Owner after bid using a value-based selection procedure. See Paragraph 1.02B.
- e. Primary Chilled Water Pumps
  - 1) BASE
    - a) Demolish existing primary chilled water pumps.
    - b) Provide and install new headered variable speed primary chilled water pumps, minimum 2.
  - 2) ALTERNATE 4:
    - a) Refurbish existing primary chilled water pumps
      1. Replace impeller, bearings, and seals
      2. Provide new motors
    - b) Re-pipe pumps in a headered configuration
  - 3) ALTERNATE 5: Provide and pipe one redundant primary chilled water pump. Provide additional VFD to be installed and wired by Division 26.
- f. Secondary Chilled Water Pumps
  - 1) BASE
    - a) Demolish existing secondary chilled water pumps.
    - b) Provide and install new headered variable speed secondary chilled water pumps, minimum 2 each sized for 50% of the load.
  - 2) ALTERNATE 6: Refurbish existing secondary chilled water pumps
    - a) Replace impeller, bearings, and seals
    - b) Provide new motors
    - c) Pipe a new check valve for each pump
  - 3) ALTERNATE 7: Provide and pipe one redundant variable speed secondary chilled water pump. Provide additional VFD to be installed and wired by Division 26.
- g. Buffer Tank: Provide a new chilled water buffer tank to act as the common leg.
- h. Cooling Towers
  - 1) Demolish existing three-cell cooling tower
  - 2) Provide and install new cooling towers in accordance with the following:
    - a) Variable speed
    - b) Minimum two cell (or two towers)
    - c) Cooling towers shall be located where all manufacturer's recommended clearances and intake air velocities are maintained. See Drawing M-2.01 for cooling tower enclosure dimensions.
    - d) Install structural support for cooling tower. Structural calculations shall be prepared and stamped by a registered professional structural engineer and included in tower submittal for review by Engineer.
    - e) See Paragraph 1.16A for design temperatures
  - 3) Cooling towers will be selected in conjunction with the Contractor, Engineer, and Owner after bid using a value-based selection procedure. See Paragraph 1.02B.

- i. ALTERNATE 8: Cooling tower filtration system
  - 1) Procure packaged separator system completely factory assembled.
  - 2) Size for filtration of one cell at a time.
  - 3) Pipe and install filtration system.
  - 4) See Drawing M5.01.
- j. Condenser water pumps
  - 1) Demolish existing three condenser water pumps.
  - 2) Provide and install new headered variable speed condenser water pumps, minimum 2.
  - 3) ALTERNATE 9: Provide and pipe one redundant condenser water pump. Provide additional VFD to be installed and wired by Division 26.
- k. Condenser water treatment system
  - 1) Demolish existing water treatment system.
  - 2) Provide and install new water treatment system. Locate chemical tanks where they are readily accessible for refill without having to lift chemicals over piping or other obstructions.
- l. Chilled Water Treatment System
  - 1) Demolish existing pot feeder.
  - 2) Provide and install new bypass pot feeder.
- m. Piping
  - 1) Note that results from a hazardous materials assessment will be provided as an addendum to the RFQ for contractor's reference.
  - 2) BASE
    - a) Condenser Water Piping
      - 1. Demolish all condenser water piping in existing cooling tower enclosure and chiller room. This excludes underground condenser water piping which is carried in the civil scope.
      - 2. Provide new piping in accordance with Drawing M5.01.
    - b) Chilled Water Piping
      - 1. Demolish all chilled water piping up to point of connection shown below. Note the drawing below is original piping. The plant layout has since been altered, but the chilled water at the point of connection remains the same.



2. Provide new piping in accordance with Drawing M5.01.

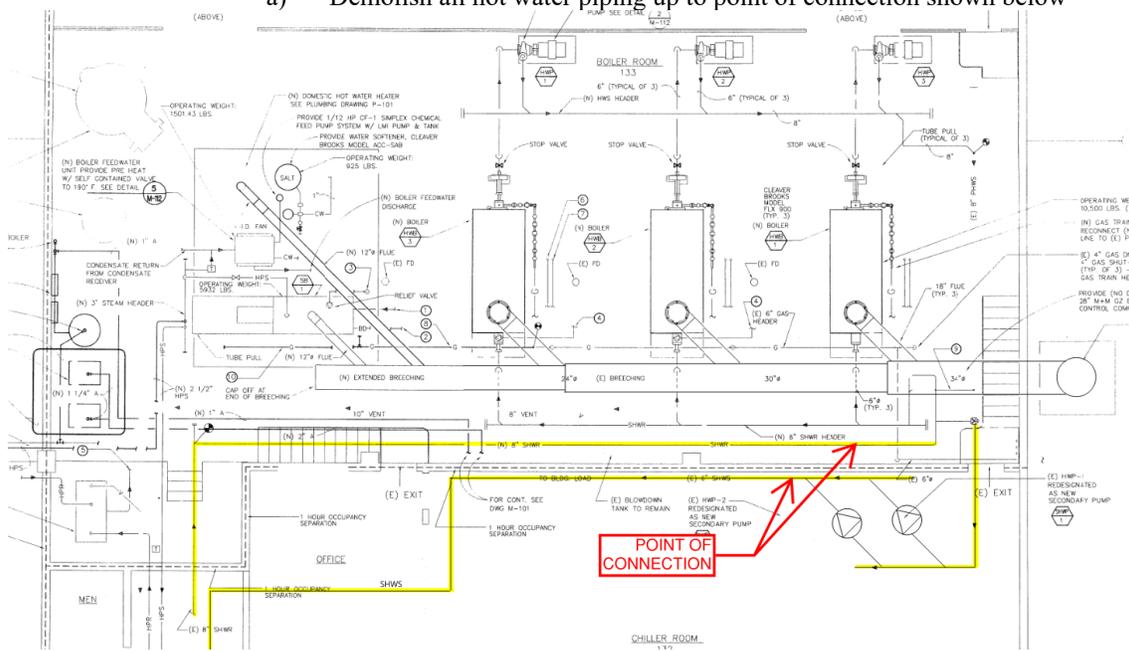
3) ALTERNATE 10:

- a) Contractor shall retain a non-destructive testing firm to test condition of existing chilled and condenser water pipe in chiller room.
  - b) Demolish all condenser water piping in existing cooling tower enclosure. This excludes underground condenser water piping which is carried in the civil scope.
  - c) Demolish all chilled water piping and condenser water piping in the chiller room as required to install new equipment and all piping that will no longer be used. Install new piping to make equipment connections as required.
  - d) Demolish all chilled water piping and condenser water piping the has a pipe wall thickness loss of greater than 10% of original pipe wall thickness.
  - e) For the purpose of this alternate, assume 15% of the original CW and CHW pipe intended to be used to complete the scope of this work will require replacement. If alternate is selected, a price adjustment will be made if more than 15% of the original pipe requires replacement, but will not exceed the cost to replace all condenser and chilled water pipe as submitted per Paragraph 1.02C.3.a.2)a) and Paragraph 1.02C.3.a.2)b).
  - f) Reuse all other chilled water and condenser water piping in chiller room.
  - g) Final water piping shall be in accordance with Drawing M5.01.
- n. Valves and Piping Accessories
- 1) Demolish all condenser water valves and chilled water valves and piping devices associated with the chiller, condenser water pumps, and primary and secondary chilled water pumps. This includes all shut off, check, and control valves, all strainers, and all other piping system devices.

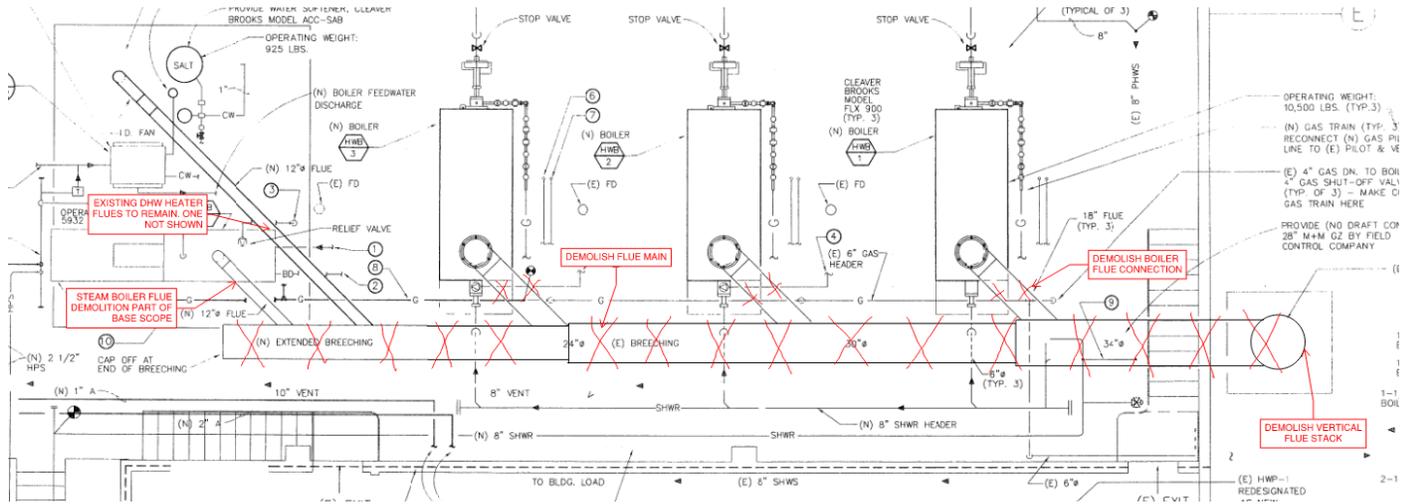
- 2) All valves and piping accessories shall be new including expansion tank and air separator.
  - o. Variable speed drives, disconnect switches, and all associated wiring
    - 1) Demolish all variable speed drives, disconnect switches, and associated wiring
    - 2) Provide new variable speed drives for primary chilled water pumps, secondary chilled water pumps, condenser water pumps, and cooling towers to be installed and wired by Division 26.
  - p. Housekeeping Pads and Inertia Bases
    - 1) Demolish inertia bases.
    - 2) Demolish housekeeping pads not required for final design.
    - 3) Reuse, extend, or modify existing housekeeping pads where possible.
    - 4) Provide new housekeeping pads where required.
  - q. Refrigerant detector along with manual switches for emergency shutdown and exhaust are provided under Division 25 BAS.
2. Central Boiler Plant
- a. Hot water plant shall be design within 10% of current capacity.
  - b. Provide a gas-fired hot water plant with non-condensing boilers and primary-secondary distribution.
  - c. Maintain minimum clear space requirements for future equipment to be installed when transitioning to an all-electric plant. See Drawing M2.01.
  - d. Demolish all existing steam equipment and associated piping.
  - e. Boilers
    - 1) Demolish existing three gas-fired hot water boilers (Cleaver Brooks FLX-900).
    - 2) Provide and install new boilers in accordance with the following:
      - a) 20,000,000 BTUH total capacity
      - b) Minimum three
      - c) Equal sized
      - d) Minimum total plant burner turndown of 12:1
      - e) Boilers shall be located where all code required and manufacturer recommended clearances are maintained.
      - f) Relocate piping, conduits, ducts etc. as required to remove old equipment and install new equipment.
      - g) See Paragraph 1.16A for design temperatures
  - f. Primary Hot Water Pumps
    - 1) BASE
      - a) Demolish existing primary hot water pumps.
      - b) Provide and install new dedicated constant speed primary hot water pumps, one for each boiler.
  - g. Secondary Hot Water Pumps
    - 1) BASE

- a) Demolish existing secondary hot water pumps.
  - b) Provide and install new headered variable speed secondary hot water pumps located in the boiler room, each sized for 50% of the total design secondary waterflow.
- 2) ALTERNATE 11:
- a) Refurbish existing secondary hot water pumps
    - 1. Replace impeller, bearings, and seals
    - 2. Provide new motors
    - 3. Pipe a new check valve for each pump
  - b) Relocate headered secondary hot water pumps to boiler room.
- 3) ALTERNATE 12 Provide and pipe one redundant secondary hot water pump. Provide additional VFD to be installed and wired by Division 26.
- h. Building E Tertiary Hot Water Pumps
- 1) Demolish existing Building E tertiary hot water pumps
  - 2) Provide new Building E tertiary hot water pumps
- i. Hot Water Treatment System
- 1) Demolish existing pot feeder.
  - 2) Provide and install new bypass pot feeder.
- j. Hot Water Piping
- 1) Results from a hazardous materials assessment will be provided as an addendum to the RFQ for contractor's reference.
  - 2) BASE

a) Demolish all hot water piping up to point of connection shown below



- b) Provide new piping in accordance with Drawing M5.02.
- 3) ALTERNATE 13:
  - a) Contractor shall retain a non-destructive testing firm to test condition of existing hot water pipe located in the central plant.
  - b) Demolish all hot water piping water piping in the central plant as required to install new equipment and all piping that will no longer be used. Install new piping to make equipment connections as required.
  - c) Demolish all hot water piping the has a pipe wall thickness loss of greater than 10% of original pipe wall thickness.
  - d) For the purpose of this alternate, assume 15% of the original HW pipe intended to be used to complete the scope of this work will require replacement. If alternate is selected, a price adjustment will be made if more than 15% of the original pipe requires replacement, but will not exceed the cost to replace all hot water pipe as submitted per Paragraph 1.02C.3.a.2)c).
  - e) Reuse all other hot water piping in the central plant.
  - f)Final water piping shall be in accordance with Drawing M5.02.
- k. Natural Gas Piping
  - 1) Connect natural gas piping to new gas trains for each new boiler.
- l. Valves and Piping Accessories
  - 1) Demolish all hot water valves and piping devices associated with the boiler and primary and secondary hot water pumps. This includes all shut off, check, and control valves, all strainers, and all other piping system devices.
  - 2) All valves and piping accessories shall be new including expansion tank and air separator.
- m. Boiler Flue
  - 1) Contractor shall retain a non-destructive testing firm to test condition of existing flue located in the central plant. Wall thickness tests shall be conducted on both the horizontal main and the exterior stack.
  - 2) BASE:
    - a) Demolish existing boiler flue for each existing boiler up to boiler flue main and cap.
    - b) Connect each new boiler into existing engineered flue. Contractor to verify flue requirements upon boiler selection.
  - 3) ALTERNATE 14
    - a) Demolish existing boiler flue for each existing boiler back to boiler flue main, flue main, and exterior vertical flue stack.
    - b) Provide and install new flue main and vertical flue stack extending from the boiler room. Maintain code-required clearances. Flue stack may be located on the interior or exterior of Building E. Fire-rated shaft provided by others, as necessary.
    - c) Connect each new boiler into flue main.
    - d) Reconnect existing equipment that will not be demolished into flue main.



- n. Variable speed drives, disconnect switches, starters, and all associated wiring
  - 1) Demolish all variable speed drives, disconnect switches, and associated wiring.
  - 2) Provide new variable speed drives for secondary hot water pumps to be installed and wired by Division 26.
- o. Housekeeping Pads
  - 1) Demolish housekeeping pads not required for final design.
  - 2) Reuse, extend, or modify existing housekeeping pads where possible.
  - 3) Provide new housekeeping pads where required.
- 3. Fans
  - a. Chiller Room Exhaust
    - 1) BASE
      - a) Re-use existing chiller room exhaust fan.
      - b) This requires that existing fan meets required exhaust airflow rate prescribed in UMC Chapter 11 for final mass of refrigerant in new chiller plant
    - 2) ALTERNATE 15: Provide and install new chiller room exhaust fan sized per UMC Chapter 11.
    - 3) Makeup from louver, by others, with inward facing backdraft damper by Division 23.
  - b. Storage Room Ventilation
    - 1) Provide transfer fan for storage room with integral backdraft damper.
    - 2) Makeup from louver, by others, with inward facing backdraft damper by Division 23.
- 4. Miscellaneous HVAC
  - a. Engineer's Office
    - 1) Demolish existing fan coil unit.
    - 2) Provide new fan coil unit with economizer mixing box serving the Engineer's office.
      - a) Pipe chilled water to main secondary chilled water loop.
      - b) Pipe hot water to main secondary hot water loop.

- 3) Provide outside air to fan coil via duct terminating at existing louver over the chiller room exterior door.
- 4) Provide new supply ductwork and air outlets.
- 5) Relief will be through existing wall louver.
- b. ALTERNATE 16 Boiler and chiller room conditioning:
  - 1) Demolish existing hot water fan coils serving the chiller and boiler room.
  - 2) Boiler Room
    - a) Provide and install new 3,000 CFM variable speed ventilation fan in boiler room. Connect outlet to existing louvers. Provide backdraft damper. Controls by Division 25.
    - b) Duct outlet high to wall opposite combustion air intake.
    - c) Provide screen over ducted outlet.
  - 3) Chiller Room
    - a) Provide and install new 1.5 ton, chilled water fan coil with economizer box in chiller room. Controls by Division 25.
    - b) Provide plenum downstream of fan coil with tapped supply grille.
    - c) Pipe chilled water to main secondary chilled water loop.
5. Pneumatic System
  - a. Demolish 2 LeROI compressors.
  - b. Provide new compressor with factory mounted tank to match existing compressor (Sullivan Palatek D4-25).
    - 1) Compressor capacity of 95 CFM at 125 psi.
    - 2) ASME tank capacity to match existing.
    - 3) Install compressor and associated piping and pipe accessories in lead/standby arrangement.
  - c. Air dryer
    - 1) Demolish existing Van Air compressed air dryer.
    - 2) Procure and install new air dryer (200 SCFM at 100 psig, 100°F) to match existing.
6. Steam System Demolition
  - a. Demolish existing steam system including steam boiler, boiler feedwater unit, steam chemical feed pump system, water softener, condensate receiver, pumps, and blowdown tank.
  - b. Demolish all piping and piping accessories associated with steam system back to mains at utility corridor. This includes but is not limited to steam vent pipe, condensate pipe, high pressure steam pipe, and chemical feed lines.
- D. Alternative Systems
  1. HVAC contractors may propose any system for consideration.

## 1.16 DESIGN CRITERIA

- A. Design Temperatures

Design Condition	Heating	Cooling
Outside air drybulb	31°F	89°F
Coincident outside air wetbulb	–	66°F
Outside air wetbulb for cooling tower sizing	–	67°F
Chiller Room		75°F
Boiler Room		80°F
Maximum design supply air (at outlet)	95°F	65°F
Minimum design supply air (at outlet)	–	57°F
Design hot/chilled water supply	180°F	42°F
Design hot/chilled water temperature difference (primary)	30°F	12°F
Design hot/chilled water temperature difference (secondary)	30°F	12°F
Future design hot/chilled water supply (All-electric)	130°F	42°F
Future design hot/chilled water temperature difference (All-electric)	25°F	23°F
Design condenser water, chillers	–	74°F
Minimum condenser water temperature difference	–	12°F
Maximum condenser water temperature difference	–	15°F

- B. Design Relative Humidity
  - 1. No active control.
- C. Sound and Vibration Control:
  - 1. Maximum noise levels shall be as indicated below. **The HVAC Contractor shall retain an acoustical consultant to approve the system design as meeting the specified NC requirement of NC 55 in equipment rooms and analyze acoustic performance of cooling towers at time of equipment selection.** Acoustical consultant shall determine the sound pressure level in dBA at 7<sup>th</sup> street sidewalk and Building F exterior stairs at grade for proposed tower selections.
  - 2. The acoustical engineer’s cooling tower related calculations shall be submitted to the Engineer for review and comment prior to cooling tower selection. All other calculations shall be submitted to the Engineer for review and comment at the end of the construction documents phase. Vibration in walls and floors shall not be perceivable to the touch in any occupied space.
  - 3. Final installation for the cooling tower shall comply with all applicable local noise ordinances.
- D. Miscellaneous Design Constraints
  - 1. Louvers: Louvers need not be as shown on architectural plans; size and position to be determined by HVAC Contractor
  - 2. Location of ceiling mounted systems and equipment
    - a. Equipment shall be located where readily accessed for maintenance, not over light fixtures, ceiling height partitions, or large, difficult-to-move furniture such as cabinets and desks. Where possible, locate in corridors or over entry doors to rooms where it is assured no furniture will be located below.
    - b. Do not locate any equipment requiring access doors above drywall or other inaccessible ceilings in public areas, conference rooms, etc. (Ceiling access doors are acceptable in toilet rooms and other back-of-house type spaces.)

- c. Space shall be provided around all equipment for routine maintenance and inspection in strict accordance with recommendations of the manufacturer. Service and maintenance access space and access doors shall not be blocked by conduit, sprinkler lines, cable trays, ceiling hangers, etc.
- E. Exhaust and make-up air systems
  - 1. Chiller Room
    - a. Provide refrigerant exhaust fan, as required by the CMC. (Refrigerant detector along with manual switches for emergency shutdown and exhaust are provided under Division 25 BAS.)
    - b. Sound and energy efficiency are not issues in fan or outlet selection.
  - 2. Boiler room gas flues and combustion air
    - a. Contractor to verify existing flue duct construction is suitable for new boilers.
    - b. Contractor to verify existing combustion air louvers are appropriately sized. Additional combustion air louvers shall be sized by Contractor and coordinated with architect, though additional combustion air openings are not expected to be required.
- F. Air Distribution System Design
  - 1. Duct Sizing
    - 1) Ductwork Downstream of Fan-Coils: Sheet metal ducts shall be sized for average friction rates below 0.1" per 100 feet.
    - 2) Refrigerant Exhaust Fan: limit velocity to 2,500 fpm
  - 2. Ducts exposed to occupant view
    - a. Avoid reducers
    - b. Duct sealant shall be clear and concealed in the joint, invisible to occupants.
    - c. Ducts shall not intersect wall corners or run parallel to and within a full height wall.
    - d. Materials shall be de-greased or otherwise ready to paint (paint by others).
    - e. Duct mounted grilles
      - 1) Mount sidewall grilles/slots in taps that are sized for the outside dimension of the grille frame with flange turned in.
      - 2) Grilles shall be mounted to discharge horizontally, not angled down.
    - f. Taps to grilles, tees, wyes, etc.: Have flanges at duct connection inside the duct concealed from view
  - 3. Velocities and pressure drops through other air distribution devices shall be limited to the following:

<b>Duct Component</b>	<b>Maximum velocity ft/min</b>	<b>Maximum pressure drop, "W.C.</b>
Unducted control dampers	1000	0.03
Outside air intake louvers	As required to prevent rain entrainment	0.15
Exhaust air louvers	–	0.05
Filters (through face area)	500	–
Cooling coils	500	0.95

Heating coils	800	0.35
Transfer U-boot (no grilles)	900	-
Transfer boot/duct with one grille	475	-
Transfer boot/duct with two grilles	375	-

4. Layout
  - a. Ductwork shall not be run through electrical rooms, even where above ceilings, unless they serve the space and meet the restrictions in the Electrical Code.
  - b. Walls around all conference, IDF/MDF, and project rooms will be full height. Provide return air acoustical transfer ducts and grilles accordingly.
  - c. Return grilles and/or transfer ducts are not needed in the following situations. This assumes that the door has normal ¼” door undercuts; verify that there are undercuts – some doors will have acoustic threshold seals that will completely block airflow.
    - 1) Rooms with full height walls or drywall ceilings: 45 cfm per door plus 30 cfm through wall and/or ceiling leakage.
    - 2) Rooms with tee-bar ceilings and non-full height walls: 45 cfm per door plus 30 cfm or 0.15 cfm/ft<sup>2</sup>, whichever is larger, through wall and/or ceiling leakage.
  - d. Ductwork shall not be exposed on the roof unless absolutely necessary due to architectural constraints or acoustical requirements. Rectangular ducts located outdoors shall be sloped so that water does not accumulate.
5. Dampers: Mount so that actuators may be direct-coupled (not mounted to damper blade) one actuator per section.
6. Balancing:
  - a. Balancing will be performed by adjusting the fan motor speed or with sheaves.
  - b. Do not use splitters, extractors, or manual balance dampers for balancing.
7. Air Outlets
  - a. Styles listed are Price. Equals by Titus, MetalAire, etc. are acceptable.
  - b. Select diffusers for 5 NC less than maximum room NC.
  - c. Styles
    - 1) General Office, tee-bar ceilings
      - a) Interior supply
        1. Price PDSP star-pattern perforated (with black painted back pan and deflectors) or SPD plaque diffusers, maximum 350 cfm, at Contractor’s option
        2. Maximum 12” neck size
      - b) Return: 2x2 perforated, Price PDDR with light shield or equal
    - 2) No ceilings
      - a) Supply on exposed duct: High duct elevation, bottom: Double deflection (Price 520-S) Adjust rear blades horizontal 22 degree upward and splay front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
  - d. Borders and Frames: Use frames with concealed fasteners; no visible screw heads

G. Water Distribution Systems

1. Piping shall be sized using either the performance or prescriptive procedure described below.
  - a. Performance Approach
    - 1) Optimize pipe using life cycle costs using this spreadsheet: [http://www.taylor-engineering.com/Websites/taylorengineering/images/guides/Pipe\\_Size\\_Optimization\\_Tool.zip](http://www.taylor-engineering.com/Websites/taylorengineering/images/guides/Pipe_Size_Optimization_Tool.zip). Provide spreadsheets for TE review to confirm proper implementation.
  - b. Prescriptive Approach
    - 1) Piping shall be designed in accordance with the table below. "Noise Sensitive" spaces are spaces designed for NC 40 and below.

Pipe Size	Secondary Hot and All Chilled Water		Primary Hot and Condenser Water to Chillers	
	Non-noise Sensitive	Noise Sensitive	Non-noise Sensitive	Noise Sensitive
½"	7.8	1.8	5.0	1.8
¾"	18	4.6	12	4.6
1"	29	8.9	19	8.9
1-1/4"	51	15	34	15
1-1/2"	88	24	57	24
2"	120	51	73	51
2-1/2"	160	81	100	81
3"	270	140	180	140
4"	480	280	320	280
5"	670	490	430	430
6"	1,100	770	700	700
8"	1,800	1,500	1,200	1,200
10"	2,900	2,700	1,900	1,900
12"	4,400	4,200	2,900	2,900
14"	6,000	5,400	4,000	4,000

- c. Devices: Design pressure drop shall not exceed the following:
  - 1) Coils: 15 feet
2. Pump head estimates for pumps are shown in schedules on Drawing M0.02. Pump heads shall be calculated using the spreadsheet specified in Paragraph 1.16G.1.a.1) regardless of how piping was sized.
3. Layout
  - a. Piping shall not be run above electronic equipment. Where absolutely necessary, provide drain pans to minimize damage due to leaks.
  - b. Piping shall not be run through electrical rooms, even where above ceilings.
  - c. Piping shall be inside building or cooling tower enclosure, no exposed piping acceptable. Piping may be suspended high along walls if tight to wall and over 7' above the adjacent walking surface.
4. Pump Types
  - a. Small pumps (<~75 gpm, ~2HP) where accessible mounted in-line with piping:
    - 1) Close-coupled inline

- b. Variable speed, <~2000 gpm:
    - 1)  $\leq$ 20HP: Close-coupled end-suction
    - 2) >20HP: Flex-coupled end-suction with flexible polyurethane coupling
  - c. Constant speed, <~2000 gpm:
    - 1)  $\leq$ 15HP: Close-coupled end-suction
    - 2) >15HP: Flex-coupled end-suction with EPDM coupling
  - d. >~2000 gpm:
    - 1) Double suction, flex coupled
5. Balancing
- a. Variable flow systems (two-way modulating valves): No balancing required for two-way valve systems.
  - b. Constant flow systems: For devices with a design pressure drop exceeding 2 psi, flow as indicated by coil pressure drop using test plugs may be used in lieu of balancing valves.
  - c. Do not provide balancing valves at pumps (e.g. triple duty valves).
6. Hot water systems
- a. Systems shall be primary/secondary distribution with constant flow primary pumps and variable flow and variable speed secondary pumps.
7. Chilled water systems
- a. System shall be primary/secondary distribution with variable flow and variable speed.
  - b. Provide a chilled water buffer tank
    - 1) Tank serves as the common leg between the primary and secondary loop.
    - 2) Tank sized for minimum cycle time of 45-minutes (22.5 minutes on, 22.5 minutes off) at 10% of a single chiller's load.
8. Condenser Water Systems
- a. Condenser water systems serving chillers shall be staged constant flow, constant speed when chiller compressor operates.
  - b. Provide condenser water pumps with VFDs for variable flow during chiller "free cooling" operation.
- H. Indoor Air Quality Measures
- 1. Coils: Individual finned-tube coils shall be meet Standard 62.1 requirement (no greater than 0.75" pressure drop when dry (no condensation) and rated at 500 fpm) to ensure coil cleanability. Multiple finned-tube coils in series shall also meet this constraint together unless 1.5 feet minimum width access sections with access doors are placed in between each coil.
  - 2. Dehumidifying Cooling Coils: Field assembled and custom factory assembled dehumidifying cooling coils shall be selected for no more than negligible water droplet carryover beyond the drain pan at design conditions. Unitary dehumidifying cooling coils shall be designed so that no more than negligible water droplet carryover will occur at the standard rating conditions specified by the AHRI Standard appropriate for the equipment category. For the purpose of this section, negligible water droplet carryover is defined as 0.04 oz per ft<sup>2</sup> of coil area per hour. Drains and drain pans as specified below shall be provided under all dehumidifying cooling coils. Equipment and other obstructions in the air stream shall be located sufficiently downstream of the coil that it will not come in contact with water droplet carryover.

3. Drains and Drain Pans: Drain pans located in fan coil units, and other locations shall be designed and field tested to ensure proper slope and drainage and to prevent conditions of water stagnation that result in microbial growth. Drainage shall be considered acceptable if after covering the entire pan with ½” water, the pan drains within 3 minutes with the fan system in operation to leave puddles no more than 2” in diameter and no more than 1/8” deep.
  4. Access: Space shall be provided around all ventilation equipment as recommended by the manufacturer for routine maintenance and inspection including but not limited to filter replacement and fan belt adjustment and replacement. Access doors or panels shall be provided in ventilation equipment, ductwork and plenums as required for in-situ inspection and cleaning of the following:
    - a. Outdoor air intake plenums
    - b. Mixed air plenums
    - c. Upstream of heating coils
    - d. Upstream and downstream surface of cooling coils
    - e. Filters
    - f. Drain pans
    - g. Fans
  5. Filtration
    - a. All fan systems shall have a filter to protect ductwork and coils from particulate accumulation.
    - b. Minimum filter efficiency as rated by ASHRAE Standard 52.2: 4 inch pleat, MERV 13.
    - c. MERV 8 prefilters in front of high efficiency filters shall be provided only during construction. The prefilters shall be discarded prior to final TAB tests.
- I. Energy Conservation Measures
1. Motors
    - a. All 3-phase motors shall be premium efficiency.
    - b. All single phase motors shall be electrically commutated motors (ECMs).
    - c. Motors driven by variable frequency drives shall meet the requirements of NEMA MG-1 part 31.40.4.2. No exceptions.
  2. Pumps
    - a. Variable flow systems shall have variable speed drives.
    - b. Pumps in parallel shall be able to be staged with associated chiller/boiler/cooling tower using automatic isolation valves at associated devices.
  3. Fans
    - a. All fan-coils shall have variable speed drives or ECMs for single zone VAV control logic.
  4. Cooling Towers
    - a. Fans shall have variable speed drives.
    - b. Tower internal distribution shall be selected for low flow so that all towers can operate at the same time when only one CW pump is operating.
    - c. Condenser water pumps will have variable speed drives to modulate water flow during chiller “free cooling” to maximize the number of “economizer” hours.
  5. Equipment Efficiency: See specific equipment requirements under Materials below.

- J. Redundancy and Reliability
  - 1. Provide a minimum of two pumps for each service, sized for 50% of design
  - 2. Provide a minimum of three boilers, sized for 33% of design
  - 3. Provide a minimum of two chillers, sized for 50% of design
  - 4. Provide a minimum of two cooling towers or one dual cell tower. Towers or cells shall be completely independent (separate basins, make-up, drain, supply, and return) and connected by an equalizer pipe that can be shut off to allow one tower/cell to operate alone.
  - 5. All variable speed drives shall be located indoors in nearby mechanical or electrical rooms/closets unless the separation distance would be longer than manufacturer's limits. Exterior VFDs shall be located in a NEMA 3R or 4X Enclosure.

## **PART 2 MATERIALS**

### **2.01 CHILLERS**

- A. Chillers will be selected after bid. Include stipulated price in Paragraph 1.02B.3.a.

### **2.02 COOLING TOWERS**

- A. Cooling Towers will be selected after bid. Include stipulated price in Paragraph 1.02B.3.c.1).

### **2.03 ALTERNATE 8 TOWER FILTRATION SYSTEM**

- A. Packaged separator system completely factory assembled.
  - 1. Centrifugal vortex type separator
  - 2. Pump
  - 3. Controls
  - 4. Interconnecting piping, schedule 80 PVC
  - 5. Mounted on an epoxy coated steel skid
- B. Separator
  - 1. Tangential entry to ensure proper helical flow
  - 2. Expected solids performance rating at or above 98 percent efficient at 74 microns and larger (with a specific gravity of 2.6 or greater) on a single pass
  - 3. Inlet/outlet gauges to monitor pressure
  - 4. Manual air relief valve at the top of the vessel
  - 5. Fabricated of carbon steel, rated at 150 psi working pressure, tested at 1.5 times the design pressure
  - 6. Finish: fusion bonded epoxy coating
- C. Pump
  - 1. Close coupled, end suction type
  - 2. Cast iron construction, bronze fitted
  - 3. Standard efficiency, TEFC motor
  - 4. Cast iron pre-strainer with a perforated stainless steel basket
  - 5. Starter with HOA switch and overload short circuit protection

- D. Purge
  - 1. Purging of the accumulation chamber shall be accomplished without interrupting flow or excessive loss of system fluid. Purge rate shall be low enough that it can be accommodated by a standard 3" floor sink.
  - 2. Include automatic controls consisting of an electrically actuated two-way brass ball valve with a HOA switch and solid state purge timer mounted in the control panel
- E. Electrical and Controls
  - 1. Complete packaged control system
  - 2. NEMA 3R or 4X enclosure
  - 3. Single electrical connection point
  - 4. Dry contact for remote start/stop

## 2.04 HOT WATER BOILERS

- A. Boilers will be selected after bid. Included stipulated price in Paragraph 1.02B.3.b.

## 2.05 PUMPS

- A. Manufacturers: PACO, Bell and Gossett, equal
- B. Construction
  - 1. Bronze or stainless steel impeller
  - 2. Mechanical seals
  - 3. Construction to permit complete servicing without breaking piping connections
  - 4. Pumps and flanges tested and rated to withstand 1-1/2 times specified working pressures based on both inlet pressures scheduled and pump shut-off head or 175 pounds per square inch working pressure at 250 degrees Fahrenheit, whichever is greater.
  - 5. Pumps to be suitable for handling fluids at scheduled temperatures
  - 6. Pressure taps on both inlet and outlet for gauge connection mounted in the pump casing (not in external piping).
  - 7. Factory tested
  - 8. Painted with at least one coat of high-grade machinery enamel
- C. Pump characteristics
  - 1. Pump curve shall rise continuously from maximum capacity to shutoff
  - 2. Shutoff head approximately 10 percent greater than design head
  - 3. Operation between 65% and 115% of GPM at best efficiency point (BEP) for the indicated impeller size, ideally between 85% and 105% of GPM at BEP.
  - 4. For pumps serving variable flow (2-way valve) systems or where multiple pumps operate in parallel
    - a. Pump shall be capable of operating at 40 percent beyond design flow rate without exceeding break off point
    - b. Motors shall be selected for non-overloading operation at a flow rate 40 percent beyond design flow rate
  - 5. Impeller diameter
    - a. Minimum tip to cutwater clearance: 4%

- b. Constant speed pumps: Trim to duty
- c. Variable speed pumps: Trim to the maximum impeller size that does not cause an increase in motor size (so that maximum efficiency is achieved).
- 6. Flex-coupled
  - a. Removable OSHA coupling guards
  - b. Flexible couplings
    - 1) Constant speed: EPDM equal to Woods Sure-Flex
    - 2) Variable speed: Flexible polyurethane equal to Woods Dura-Flex or Dodge Para Flex
- D. Motors
  - 1. Premium efficiency
  - 2. Motors exposed to outdoors shall be TEFC
  - 3. For variable speed driven pumps, motors shall meet the requirements of NEMA MG-1 part 31.40.4.2.
  - 4. 1800 rpm or less

## 2.06 FAN COIL UNIT

- A. Price Industries, Envirotech/Johnson Controls/York, Trane, Carrier, Daikin, or equal
- B. Comply with all Indoor Air Quality Measures and Energy Conservation Measures described above
- C. Insulated housing with minimum 3/4", 1.5 pound fiberglass or foam insulation
- D. Include filters as scheduled
- E. Hang unit with spring isolation
- F. Motors: direct drive, ECM
- G. Coils: Minimum 6 rows, 10 fpi
- H. Units in electrical and electronic equipment rooms or over electrical or electronic equipment shall have auxiliary condensate drain pans and secondary condensate drain. All others shall have condensate high level switch factory wired to shut off fan.

## 2.07 COMPRESSORS

- A. Sullivan Palatek
- B. Direct drive compressor
- C. Oversized air intake
- D. Factory mounted separator tank
- E. Factory installed 120 gallon ASME tank
- F. Factory installed gauges
  - 1. Line pressure
  - 2. Discharge pressure
  - 3. Temperature
  - 4. Oil filter differential

- 5. Separator element
- 6. Run hour meter
- G. Magnetic line voltage motor starter

## 2.08 COMPRESSED AIR DRYER

- A. Equal to Van Air Systems RA-200

## 2.09 FANS (GENERAL)

- A. Fans shall be tested and rated in accordance with AMCA Standards and shall bear AMCA Labels
- B. Wheels shall be balanced statically and dynamically, free from vibration or noises
- C. Bearings self-aligning, ball-bearing type, complete with grease fittings, extended to single point on drive side or to accessible location
- D. Actual brake horsepower of fan and drive shall not exceed nameplate rating of motor driving fan
- E. Provide adjustable sheaves for one-to-two-strand belt drives on motors 15 HP or less. Sheaves shall be selected to operate at mid-point of fan curve to allow adjustment in both directions. For belt drives with more than two strands serving motors over 15 HP, provide fixed sheaves. Replace fan sheaves as necessary to obtain desired results.

## 2.10 EXHAUST FANS

- A. Cook, Greenheck, Twin City or equal
- B. Provide back draft dampers on exhaust fans as required by code and Title 24.

## 2.11 MOTORS

- A. General
  - 1. In accordance with NEMA, IEEE, and ANSI C50 standards
  - 2. Sized to operate driven devices under all conditions without overload
  - 3. Minimum service factor: 1.15
  - 4. Type
    - a. 1/2 horsepower and smaller: AC motor single-phase, 60 hertz, NEMA rated for 110 volt, with built-in overload protection
    - b. 3/4 horsepower and larger: AC motor 3 phase, 60 hertz, AC motor, NEMA rated for 460 volt or as available
    - c. Motors 50 horsepower and over: Reduced voltage start, suitable for star-delta starting
- B. Enclosure
  - 1. Open drip-proof (ODP): Provide ODP motors unless otherwise indicated
  - 2. Totally enclosed (TEFC):
    - a. Non-ventilated: under 1/2 horsepower
    - b. Fan-cooled: 1/2 horsepower and larger
- C. Efficiency

1. Motors 1 horsepower and larger shall be NEMA Premium™ labeled and have guaranteed efficiencies equal to or exceeding NEMA Table 12-6D.
- D. Motors driven by variable frequency drives
1. Shall meet the requirements of NEMA MG-1 part 31.40.4.2.
  2. Where used for pumps or fans (variable torque), shall have minimum 10:1 turndown and be capable of operating at 10 percent speed indefinitely.

## 2.12 VARIABLE SPEED DRIVES

- A. ABB, Danfoss, Cerus, equal
- B. Electrical Characteristics
1. Efficiency shall be not less than 97% at rated voltage, current, and frequency and fundamental power factor shall not be less than 98% at all speeds and loads.
  2. Provide as a minimum 5% impedance line reactors. The 5% impedance may be from dual (positive and negative DC bus) reactors or 5% AC line reactors. VSDs with only one DC reactor shall include AC line reactors.
  3. VSD shall automatically mitigate harmonics throughout the effective load range using Swinging chokes or other devices designed to lower harmonics when VSD is at partial loads.
  4. Include Ferrite Core EMI/RFI/Common mode filters. The onboard filters shall allow the VSD assembly to be CE Marked and the VSD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2).
- C. Features and Accessories
1. Plain language LCD display (code numbers not acceptable); all set-up parameters, indications, faults, warnings, and other information must be displayed in words, not codes
  2. Displays and meters for the following
    - a. Output voltage
    - b. Output frequency
    - c. Motor rpm
    - d. Motor current
    - e. Motor watts
    - f. Speed signal input
    - g. Last three faults
  3. HOA switch and speed potentiometer
  4. Integral circuit breaker
  5. Adjustable or multiple carrier frequencies up to 12 kHz. Include a carrier frequency control circuit that reduces the carrier frequency based on actual VSD temperature that allows the highest carrier frequency without derating the VSD or operating at high carrier frequency only at low speeds.
  6. Isolated 4-20 mA or 0-10 Vdc speed signal input. If the input reference is lost the VSD shall, based on user selectable option, either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the speed based on the last good reference received, or (4) cause a warning to be issued.
  7. Analog outputs for kW and speed; kW shall be accurate to  $\pm 3\%$
  8. Digital outputs for alarm and motor on/off status; latter shall be based on field adjustable motor current that can indicate broken belt or coupling

9. Auto-restart after trip due to
    - a. Overcurrent
    - b. Under-voltage
    - c. Over-voltage
    - d. Over-temperature
    - e. Auto-restart upon correction of causative condition
    - f. Include a maximum of 3 restart attempts for over-current only, with VFD shutting down and requiring manual restart after the third attempt; the attempt counter shall reset after 10 minutes of successful operation
  10. Automatic limit speed to prevent over-current on pumps or fans with overloading characteristics
  11. Provide manual bypass as indicated in Energy Conservation Measures above
  12. Controls
    - a. Provide a minimum of three digital outputs that can be programmed for multiple purposes and also controlled through the BAS network interface device by the BAS independent of other VSD functions or status. Control sequence possibilities shall include:
      - 1) Contact to open fan discharge damper either with fan start or independent of fan operation, controlled via the BAS and wait for the damper end switch to make before starting the drive; this shall function in the normal drive mode, bypass mode (if bypass is provided), and life safety mode (if part of smoke control system).
    - b. Provide built-in PID control loop, allowing connection of a pressure or flow signal to the VSD for closed loop control.
    - c. Provide factory installed BACnet/MSTP network interface that allows all VSD control points to be communicated to BAS. See Division 25 Building Automation Systems. At a minimum, the following points shall be provided:
      - 1) Read only: Speed feedback, output speed, current, % torque, kW power, kilowatt hours (resettable), operating hours (resettable), drive temperature, digital input status, analog input values, all diagnostic warning and fault information, keypad “Hand” or “Auto” selected, bypass selected, deceleration rate, and acceleration rate
      - 2) Read/write: On/off, output speed, digital output open/close, analog output values, remote fault reset, PID setpoint and gains, force the unit to bypass, maximum speed, and minimum speed.
- D. Equipment Protection and Safeties
1. VFDs short-circuit interrupting rating shall equal or exceed the fault current available at the drive.
  2. VFD shall protect itself against all normal transients and surges in incoming power line, any grounding or disconnecting of its output power, and any interruption or run away of incoming speed signal without time delay considerations. Protection is defined as normal shutdown with no component damage.
  3. The VSD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VSD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
  4. VFD must protect itself against all phase-to-phase or phase-to-ground faults.
  5. VFD shall be able to start into a rotating load at all speeds (forward or reverse) without trip.

6. Anti-regeneration circuit shall match the deceleration rate of the drive to that of the motor to prevent high bus voltage shutdown common to high inertia loads, such as fans.
  7. VFD shall ride through an input power dip of 3 cycles without trip.
  8. VSD shall operate properly at a -35% to +30% voltage fluctuation from rated voltage.
  9. VSD shall operate properly at a 10 percent frequency variation from rated frequency.
  10. VFD shall employ three current limit circuits to provide trip-free operation: slow current regulation, rapid current regulation, and current limit switch-off limit. VFD shall be designed so that overcurrent trip shall be at least 315% of the drive's current rating.
  11. VSD shall have the ability to set a maximum current available to the motor.
  12. VSD shall withstand unlimited switching of the output under full load, without damage to the VSD. Operation of a disconnect switch between the motor and VSD shall not have an adverse effect on the VSD, whether the motor is operating or not. Controls conductors between the disconnect and the VSD shall not be required for the safe and reliable operation of the VSD.
  13. The VSD shall withstand switching of the input line power up to 20 times per hour without damage to the VSD.
  14. The VSD shall be capable of operating continuously at full load in the following service conditions
    - a. Ambient temp: 30 to 104 degrees Fahrenheit
    - b. Relative humidity: 0 to 95 percent, non-condensing
- E. Start-Up/Warranty
1. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each drive with a copy to the owner and a copy kept on file by the manufacturer.
  2. Warranty shall be 24-months from date of start-up certification including all parts, labor, travel time, and expenses.

### 2.13 CONDENSATE DRAIN PANS

- A. Stainless steel for all drain pans including fan-coils but excluding auxiliary overflow pans
- B. Comply with ASHRAE 62.1.
- C. Minimum 16-gage
- D. Condensate pan shall extend at least ½ of the coil height past the edge of the each cooling coil on the leaving air side. Drain pans shall be provided for intermediate coils in the bank as well as the bottom coil.
- E. Pan must slope and drain connection must be installed for positive drainage to prevent standing water whether fan is off or on.
- F. Intermediate pans shall drain into pan below with termination within 2" of pan.
- G. Drain connection to meet code requirements.

### 2.14 AIR OUTLETS

- A. Titus, Price, Krueger, Metal-Aire
- B. See Paragraph 1.16F.7 for styles.

## 2.15 LOUVERS

- A. Louver Design
  - 1. Extruded aluminum
  - 2. Primed for painting (painting by others)
  - 3. Equal to Ruskin ELF375X for exhaust; ELF375DX for outside air intake
  - 4. Combination louver/damper: Equal to Ruskin ELC6375, 6" frame
- B. Screen
  - 1. Aluminum wire screen
    - a. 14-gage
    - b. ½-inch mesh
  - 2. Mounted on inside of louver
- C. AMCA Certified Rating Seal: Tested in accordance with AMCA Standard 500

## 2.16 WATER TREATMENT SYSTEMS

- A. General. Retain qualified water treatment specialist for complete water treatment service including
  - 1. Prior to submitting any water treatment materials for approval, perform analysis of local makeup water including:
    - a. Collect samples of local makeup water
    - b. Conduct laboratory analysis of water samples.
    - c. Provide a written report of local makeup water conditions and recommended methods and materials for initial and ongoing water treatment of all piping systems.
    - d. For open cooling tower, determine Maximum Achievable Cycles of Concentration (COC) in accordance with:
      - 1) Title 24 Part 6 Section 110.2 (e) 2.
  - 2. Recommend methods and materials required, including cleaning and passivation procedures as needed, to provide complete chemical treatment to protect all hydronic systems from scale formations, corrosion, algae and slime growth.
  - 3. Furnish all water treatment chemicals and devices.
  - 4. Supervise installation of water treatment chemicals and systems.
  - 5. Relieve operating staff and contractor of all responsibility for chemical handling, water testing and adjusting water treatment equipment during warranty period including providing required maintenance of treatment equipment.
  - 6. During warranty period, conduct monthly visits of qualified technical representative to provide the following at a minimum, summarized in a written report to the Owner:
    - a. Collect samples from each treated system and provide laboratory analysis.
    - b. Collect coupons for systems with coupon racks and provide laboratory analysis.
    - c. Inspect and adjust water treatment controllers and devices.
- B. Closed Systems
  - 1. Pot feeder: size as appropriate to system size
  - 2. Chemicals: Charge systems with a corrosion and scale inhibitor to a concentration recommended by the water treatment supplier

- C. Open Systems
  - 1. Scale control
    - a. TDS (conductivity) controller
    - b. Conductivity sensor: Electrodeless temperature-compensating encapsulated toroidal non-contact type mounted in a PVC fitting. Contact-type probes will not be accepted.
    - c. Bleed valve, ball type with stainless steel ball and trim, spring-return normally-closed
    - d. Inhibitor tank with automatic feed pump
    - e. Test set to determine inhibitor concentration shall be included.
  - 2. Microbial control
    - a. Time controller/alternator
    - b. Dual microbiocide tanks with automatic feed pumps
    - c. Two types of biocide shall be provided, at least one effective for *Legionella*.
  - 3. Controllers shall be mounted in enclosures NEMA rated for outdoor installation where applicable.
  - 1. Include Modbus/IP or BACnet/IP interface with read/write capability of all control points and setpoints; coordinate protocol with Division 25 Building Automation Systems. Assist BAS Contractor in mapping over all available data points. Minimum points, read-only:
    - a. Conductivity
    - b. Cycles of concentration
    - c. Conductivity setpoint
    - d. Conductivity low alarm setpoint
    - e. Conductivity low alarm
    - f. Conductivity high alarm setpoint
    - g. Conductivity high alarm
    - h. Timer 1 alarm
    - i. Timer 2 alarm
    - j. Flow status
    - k. Bleed valve status
    - l. Makeup water flow
    - m. Makeup water total
    - n. Bleed water flow
    - o. Bleed water total
  - 2. Meters
    - a. Provide makeup water flow meter with pulse connection to feed controller.
    - b. Provide low pressure drop bleed water meter upstream of bleed valve.
    - c. Provide strainer at inlet to meters.
    - d. All meters to have dial face with totalizing counter reading in gallons.
  - 3. Provide coupon rack, minimum of 3 coupons.
  - 4. Chemical tanks shall be protected with spill container or double-wall tanks.

5. A sufficient supply of non-mix/non-dilute type chemicals shall be furnished for 90 days at 50% load.
6. Water treatment supplier shall provide supervisory service and instruction for installation, start-up and correct operation of the equipment in the system.
7. Manufacturer
  - a. Chemtrol CT 2000 with Modbus option
  - b. Walchem Webmaster One or WGI with Modbus option
  - c. Equal

## 2.17 PIPE MATERIALS AND JOINING SYSTEMS

- A. Piping materials shall be
  1. HW and CHW: Schedule 40 Black steel or Type "L" Copper at contractor's option.
  2. Open CW: Schedule 40 Galvanized steel or Type "L" Copper at contractor's option.
- B. Joint System
  1. Steel: welded or grooved (Victaulic)
  2. Copper
    - a. Hard temper
    - b. Wrought-copper, solder joint fittings, ANSI B16.22
    - c. 95/5 tin/antimony solder or 95.6 percent tin, 4 percent copper, 0.4 percent silver; lead free
    - d. Or Press-Fit fittings and couplings equal to Viega ProPress

## 2.18 PIPE VALVES AND ACCESSORIES

- A. Piping system components shall be selected for maximum design operating pressure based on static head, shutoff pump head, and pressure relief valve setting.
- B. Gauges
  1. Fixed gauges
    - a. Temperature gauges
      - 1) Self-powered via integral photovoltaic cells
      - 2) Weiss DVU or equal
    - b. Pressure gauge: Weksler Model AA44 with valve
    - c. Boilers to have factory mounted temperature and pressure gauge
  2. Pressure/Temperature Test Plugs: "Pete's Plug" fittings, solid brass with Nordel or EPDM valve core (or neoprene valve core for chilled water or condenser water) fitted with a color coded and marked cap with gasket.
- C. Check Valves
  1. Nibco or equal
  2. Silent
  3. Combination higher pressure drop check & balance (triple-duty) valves are not acceptable as a substitution for individual check and shut-off valve (due to high pressure drop and poor ease of use).

- D. Shut-off Valves
  - 1. Nibco or equal
  - 2. Ball or butterfly valves only
  - 3. Valves used for balancing shall have infinite position handles with memory stop
  - 4. Ball valves
    - a. Full Port 1/2 to 1 inch; Standard Port 1-1/4 and larger
    - b. Stainless steel ball and stem
    - c. Equal to Nibco 580-70-66
  - 5. Butterfly valves
    - a. Removable seats
    - b. Valve stem shall be fastened to the disc so that no liquid can reach the stem
    - c. External fasteners such as roll pins, cotters, keys, or set screws will not be allowed
    - d. Butterfly valves shall be lug type; no wafer type valves allowed
    - e. Provide manual gear operator for butterfly valves 8" and larger
  - 6. Extended neck model for all insulated lines
  - 7. Provide chain operators on all valves located higher than 7 feet above access level
- E. Pipe Supports
  - 1. Kin-line, Superstrut, or equal
  - 2. Where pipe is insulated, protect insulation at hangers by installing a 22 gauge shield and clamp sized to allow pipe insulation to pass continuously through the hanger. For piping 2" and larger, provide 360 degree high density calcium silicate insert within shield.
- F. Expansion Tanks: Amtrol, B&G or Taco bladder type, stamped and certified constructed in accordance with ASME Code for Unfired Pressure Vessels for applicable working pressure.
- G. Flexible Pipe Connectors: Not used
- H. Balancing Valves: Not used
- I. Air Separators
  - 1. Centrifugal type
    - a. ASME construction
      - 1) 125 pounds per square inch operating pressure
    - b. Steel tank
    - c. Perforated stainless steel air collector
    - d. Drain connection
    - e. Equal to
      - 1) Up to 1.5": Bell and Gossett model EAS.
      - 2) 2" and above: Bell and Gossett "Rolairtrol" model RL
  - 2. In-line type
    - a. One piece
    - b. Cast iron
    - c. Rated for minimum 125 psig working pressure and minimum 250°F liquid temperature

- d. Expansion tank connection on bottom
- e. Air vent connection on top
- f. Equal to Bell and Gossett model IAS
- 3. Provide bronze, high capacity float operated automatic air vent.
- J. Strainer
  - 1. Nibco, Mueller, or equal
  - 2. Cast iron or bronze "Y-pattern" body to match piping material
  - 3. Perforated Monel, 304 or 316 stainless steel screen
  - 4. Free area not less than 2-1/2 times inlet area
  - 5. Perforations: 1/8 inch
  - 6. Provide valve with hose bib adapter with cap for all strainers

## 2.19 VIBRATION ISOLATION & SUPPORTS

- A. Manufacturers
  - 1. Vibration Isolation
    - a. Mason Industries, Inc.
    - b. Kinetics Noise Control, Inc.
    - c. M.L. Saussé & Co. (Vibrex).
    - d. Or equal
  - 2. Seismic Restraints
    - a. Hangers and Snubbers: Any manufacturer who can verify compliance with SMACNA standards and the California Building Code
    - b. Strut: Channel Framing: Any manufacturer who can verify compliance with the CBC standards
    - c. Anchors: Drill in, wedge type: Any manufacturer within the ICBO standards approved for seismic
    - d. Snubbers: Any manufacturer within the CBC standards
- B. Vibration Isolator Types
  - 1. Housed isolation
  - 2. Size for weight of unit and associated items that hang from the springs
  - 3. Spring isolators shall incorporate following:
    - a. All springs to be single coil steel with minimum spring coil outer diameter 0.8 of loaded operating height
    - b. Horizontal spring stiffness within 0.8 to 1.25 times rated vertical spring stiffness
    - c. Corrosion resistance where exposed to corrosive environment with:
      - 1) Springs neoprene coated
      - 2) Hardware cadmium plated
      - 3) All other metal parts hot dip galvanized
    - d. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection

- e. Minimum 6mm (1/4") thick neoprene acoustical base pad on underside, unless designated otherwise
  - f. Designed and installed so that ends of springs remain parallel; neoprene cups not acceptable
  - g. Noise pads of ½ inch or 1 inch thickness below the spring base to reduce the chance that the springs shall be resonant with equipment forcing frequencies or support structure natural frequencies
  - h. Leveling device
  - i. Where operating weight differs from installed weight provide built-in adjustable limit stops to prevent equipment rising when weight is removed. Stops shall not be in contact during normal operation
- C. Anchors, Inserts and Fasteners
- 1. All anchors and inserts shall be installed according to the CBC standards
  - 2. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following:
    - a. ICBO evaluation report
    - b. Lab test report verifying compliance
  - 3. Powder Actuated Anchors
    - a. Not allowed on initial building construction; allowed only for revisions made after initial construction and with approval of Owner
    - b. Hardened steel stud with threaded shank; size of shank to match hanger rod size
    - c. Use only with non-shock loads
    - d. Maximum load safety factors
      - 1) Maximum anchor load: 100 pounds
      - 2) Static loads - 5
      - 3) Vibratory loads - 8-10
    - e. For concrete and steel; not to be used for light weight concrete, brick or concrete block
    - f. 10% testing rate required, testing by contractor
  - 4. All over-head concrete anchors or inserts shall be selected to comply with the ICBO report or CBC table for the anchor or insert
  - 5. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

## 2.20 DUCTWORK AND ACCESSORIES

- A. Materials and joints
- 1. Ductwork shall be galvanized sheet metal minimum G-60
  - 2. The gauge of metal, type of joints, hanging, reinforcing, and other details of construction shall conform to the SMACNA HVAC Duct Construction Standards.
  - 3. Static pressure classes shall be as required by the fan system and acoustical requirements with the following minimums:
    - a. Low pressure downstream of fan coil units: 1"

- b. Low pressure return air and exhaust air: associated return/exhaust fan static pressure
  - c. Transfer ducts and other ducts not connected to fans: 0.5"
  - d. Outside air ductwork: 0.5"
  - 4. Joints
    - a. Rectangular Duct
      - 1) Longitudinal seams shall be Pittsburgh.
      - 2) Transverse Joints:
        - a) Low pressure ductwork (<2" pressure class) shall be TDC, TDF, Duct-Mate or "S" and drive as allowed by SMACNA
    - b. Round and Oval Duct
      - 1) Spiral
    - c. Snap-lock joints not allowed
  - 5. Fiberglass Duct: not allowed
  - 6. Flexible Duct
    - a. Flexible duct shall be listed by UL under Class One air duct and UL 181. All flexible ducts, even low pressure ducts, shall be minimum 4" pressure class to increase longevity.
    - b. Insulated Flexible Duct
      - 1) Chlorinated polyethylene (CPE) inner liner duct permanently bonded to a vinyl or zinc coated spring steel wire helix
      - 2) Fiberglass insulating blanket; minimum R-value
        - a) Ducts outside the conditioned space and in conditioned envelope: 4.2
        - b) Ducts outside conditioned space and conditioned envelope: 8.0
      - 3) Low permeability outer vapor barrier of fiberglass bi-directional reinforced metallized film laminate
      - 4) Thermaflex M-KE or equal
    - c. Aluminum duct is also acceptable provided noise criteria can be met.
- B. Duct Flexible Connectors
  - 1. General
    - a. Conform to NFPA 701 and NFPA 90A
    - b. Flame spread rating: 25
    - c. Smoke development rating: 50
    - d. Airtight and waterproof to plus or minus 10 inches
  - 2. Construction
    - a. Metal collar at each end
    - b. Galvanized steel G60
    - c. Minimum thickness: No. 24 USSG
    - d. Minimum length: 3"
    - e. Double lock joint
  - 3. Length of fabric

- a. Minimum: 4 inch
- b. Maximum: 10 inch
4. Materials
  - a. Coated glass fabric
  - b. Sewed and cemented seams
  - c. Neoprene or woven nylon/polyester blend with vinyl coating
  - d. 22 oz. per square yard minimum
5. Ventfabrics, Inc. Ventglas or equal

## 2.21 FLUES

### A. General

1. Sizes of all flues (and combustion air ducts where used) shall be confirmed with boiler manufacturer prior to issuing submittals.
2. Flue design is considered design/build by the flue material supplier, who shall be responsible for code compliance and performance of the flue and its installation details.

### B. Category I appliances

1. Type B, double wall, factory-built, UL 441 listed for Category I appliances burning natural gas for flue gases less than 550 degrees Fahrenheit.
2. The vent shall have an inner gas carrying pipe of aluminum alloy or stainless steel. The outer jacket shall be G-90 galvanized or aluminum coated steel. The space between the inner and outer pipe, the thickness of materials, and construction of the modular sections and accessories shall be as specified by the terms of the product's UL Listing.
3. The stack system shall be from one manufacturer and shall be complete with caps, supports and seismic bracing.
4. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
5. Metal-Fab Model M, Selkirk Metalbestos RV, or equal

### C. Category III appliances

1. Positive pressure, double wall, factory-built, UL 1738 listed for Category III appliances burning natural gas
2. The vent shall have an inner gas carrying pipe of Type 304 stainless steel. The outer jacket shall be aluminum coated steel. The space between the inner and outer pipe, the thickness of materials, and construction of the modular sections and accessories shall be as specified by the terms of the product's UL Listing.
3. The stack system shall be from one manufacturer and shall be complete with caps, supports and seismic bracing.

4. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
5. Metal-Fab Model PIC, Selkirk Metalbestos PS, or equal

## 2.22 FILTERS

- A. Farr, Flanders, or equal
- B. See Design Criteria for efficiency requirements. See Paragraph 1.16H.5.b
- C. Construction Filters: Provide minimum 2" MERV 8 pleated filters

## 2.23 INSULATION

- A. Certainteed, Owens Corning, Manville, Knauf or equal
- B. Insulation shall:
  1. Meet minimum thickness requirements of Section 120.4 of Title 24 and CMC 604.1
  2. Meet mold, humidity, and erosion resistance requirements of CMC 605.0
  3. Have flame spread not more than 25 and smoke density of not more than 50 when tested as a composite installation per CMC 602.2
- C. Ductwork and Plenums
  1. In concealed spaces, including ceiling plenum: Shall be insulated with 1-1/2" Fiberglas, 3/4 lb./cubic-foot faced Duct Wrap.
  2. Where required for acoustical attenuation: Shall be internally lined with Certainteed Toughgard Duct Liner, 1-1/2 lb. density, 1" thick.
- D. HW & CHW Piping
  1. Fiberglass molded pipe insulation with all service jacket.
  2. Thickness per Title 24 requirements.
  3. All piping and devices through which water flows in normal operation shall be insulated, including coil tube bends.
    - a. Exception: Hot water piping, fittings, valves and accessories located between coils and isolation valves (for coils with 2-way valves) where located in the conditioned space the coil serves and exposed to occupant view.
  4. Fittings
    - a. Hot water: Fittings on pipe over 1/2" shall be insulated with fiberglass and finished with one piece PVC fitting cover (Zeston). Valves, flanges and irregular surfaces shall be insulated with oversized pipe covering with ASJ jacket. Exposed ends shall be finished with four ounce canvas jacket saturated in Arabol.
    - b. Chilled water: Elbows shall be insulated with PVC fitting covers (Zeston) with all joints and overlaps taped with Zeston PVC vapor barrier tape. Valves and fittings shall be insulated with fiberglass oversized insulation or molded fittings and shall be coated with two coats of Foster vapor barrier mastic reinforced with glass fabric. Butt ends of insulation shall be sealed off at 21 ft. intervals maximum or at fittings, with Foster 30- 35, or equal. Vapor barrier is to be continuous. Insulation is not required at coil headers where condensation will drip into coil drain pan.
- E. Equipment

1. Air separators, pumps, and other equipment in the piping circuit shall be fully insulated; thickness same as that for largest piping used.
2. Do not insulate expansion tank, chemical feeder or other equipment not in the piping circuit.

### **PART 3 EXECUTION**

#### **3.01 RECORD DRAWINGS**

- A. Keep an accurate dimensional record of installed systems and equipment. Maintain a set of record (“as-built”) drawings up-to-date as construction progresses. Drawings shall be maintained at the jobsite and available for inspection by the general contractor, other subcontractors, the Engineer, and Owner’s representatives.

#### **3.02 PROTECTION OF WORK DURING CONSTRUCTION**

- A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.
- B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage and deterioration during construction. Protect exposed coils with plywood or other suitable rigid covers to avoid damage to fins.
- C. Protect existing walls, doors, carpeting, etc. from damage. Any damage must be repaired at no cost to Owner.
- D. Cover motors and other moving machinery to protect from dirt and water during construction.
- E. During transport to and storage on the construction site, and during rough-in until final connections are made, all ductwork and other related air distribution component openings shall be covered with plastic to prevent contamination from dust, water, and debris.
- F. Keep openings in piping closed to prevent entrance of foreign matter.
- G. Material, Equipment or Apparatus
  1. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
  2. Remove damaged material, equipment or apparatus from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.
  3. Porous materials, such as insulation, shall be protected from weather. If such material becomes wet during construction, it shall be removed and replaced at no cost to Owner; drying is not sufficient due to possible microbial contamination.

#### **3.03 INSTALLATION AND WORKMANSHIP**

- A. All equipment and material shall be installed in a neat and workmanlike manner.
- B. Repair all damaged or temporarily removed walls, roofs, roofing, equipment, etc.
- C. Follow manufacturer’s installation instructions and recommendations.
- D. All equipment must be anchored to the building.

#### **3.04 PIPING**

- A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak resistant piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.
- B. Escutcheons: Provide stainless steel escutcheons at piping penetrations of walls where exposed to public view and required for proper appearance. Provide galvanized steel escutcheons at penetrations of masonry walls elsewhere. Escutcheons not generally required at drywall penetrations where not exposed to public view.
- C. Sleeves
  - 1. Provide sleeves where pipes pass through floors above grade, roofs, poured-in-place masonry walls, and exterior walls
  - 2. Sleeves shall be standard weight steel pipe, except sleeves for concealed piping through floors not in structural members may be 25-gauge galvanized sheet metal
  - 3. Floor sleeves for piping shall extend from the bottom of the slab to 2-inches above the finished floor
  - 4. Seal between piping and sleeve with fire-rated caulk at all penetrations of fire-rated partitions and floors
  - 5. Make sleeves through outside walls watertight. Caulk between uninsulated pipe and sleeve
  - 6. Size sleeves for insulated pipes to allow full thickness insulation
- D. Application of Piping Accessories
  - 1. This section establishes minimum requirements for installation of valves and other piping accessories. Additional devices may be installed as deemed necessary by the Contractor.
  - 2. Pressure gauges
    - a. Single gauge at all pumps, piped to pump taps
  - 3. Thermometers
    - a. Heat exchanger inlet and outlet unless temperature readings are readily provided by unit controller.
  - 4. Test plugs
    - a. Inlet and outlet of all heat exchange devices including where fixed gauges are installed
    - b. At piping temperature sensor wells (for sensor calibration)
  - 5. Air Separators
    - a. Hot water system: Centrifugal type
    - b. Chilled water system: Not required
  - 6. Strainers
    - a. Inlet to all closed circuit pumps
    - b. Inlet to open circuit heat exchange devices such as chiller condenser barrels
  - 7. Coils, evaporators, condensers, boilers, and heat exchangers
    - a. Isolation valves at inlet and outlet (individually at multi-coil banks)
    - b. Test plugs at inlet and outlet (individually at multi-coil banks)
    - c. Drains with ball valve and hose connection with cap

- d. Control valves (if required herein), with reducers as required
- e. Flow measurement (for testing and diagnostics), include one of the following:
  - 1) Calibrated balance valves. May double as isolation valves if valves are ball valves and have handles and memory stops.
  - 2) Test plugs on each side of a control valve. The valve pressure drop and Cv can be used for determining flow.
  - 3) Test plugs on each side of a heat exchanger/coil with a design pressure drop exceeding 2 psi. The heat exchanger/coil pressure drop and manufacturer's data can be used for determining flow.

### 3.05 DUCTWORK

- A. Install per SMACNA Standards.
- B. Rectangular and medium pressure duct bends greater than 45 degrees shall be curved sections, the center line radius of which shall not be less than 1-1/2 times the width of the duct in the plane of the bend. Where required due to space constraints, short radius elbows with duct splitter(s) may be used. No capped "bullhead" tees or short-radius tees permitted. On low pressure ducts, square elbows with single width turning vanes may be used. Round duct elbows may be adjustable type on low pressure systems only, with gores sealed.
- C. Flexible Duct
  - 1. Flexible duct length shall be not exceed 5 feet.
  - 2. Ducts shall be supported as required by the CMC.
- D. Grille connections (except grilles exposed to occupant view)
  - 1. Provide flexible duct connections, minimum 5 feet.
  - 2. Provide at entry to diffuser collar either:
    - a. Straight duct for 1 duct diameters or greater
    - b. Full radius elbow
    - c. Equal to Thermaflex FlexFlow Elbow
  - 3. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box
  - 4. Seal connections at grilles per seal class of upstream ductwork
- E. Ductwork Sealing
  - 1. Comply with
    - a. Title 24 Energy Standards
    - b. UL 181, 181A and 181B
  - 2. Ductwork shall be sealed per SMACNA sealing classes as follows
    - a. Return air ducts and low pressure supply air ducts exposed in conditioned space: Seal Class C
    - b. Transfer boots: None
  - 3. The gores of gored elbows and end caps shall be sealed.
  - 4. Seal using one of the following:
    - a. Duct Sealing Compound

- b. Gasketed TDC or Duct-Mate
- c. Two-Part Hard-Setting Joint Tape
- d. Rolled Elastomeric Duct Sealant if and only if
  - 1) Joint is not exposed to occupant view
  - 2) Pressure class is less than 2 inches
  - 3) Surface is clean, dry, and grease/oil-free
  - 4) Extensive pressure is applied, working the tape into the duct surface using an application tool recommended by the Rolled Elastomeric Duct Sealant manufacturer.
- 5. Flexible ducts shall be connected using Panduit strap on the inner liner, sealed with tape, then the outer liner shall be sealed with tape.

### 3.06 SEISMIC CONTROL

- A. Install seismic restraints for pipes, ducts and equipment per CBC and SMACNA or Mason Industries Guidelines for pipe and duct bracing.
- B. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning, or uplift
  - 1. Calculations required for supports and bracing for situations not covered by referenced guidelines.
  - 2. Include horizontal and vertical reaction loads at connections to building structures for all seismic restraints, including those covered by referenced guidelines. Coordinate reaction loads and attachment details with structural engineer for building.
  - 3. Calculations made and signed by registered structural engineer knowledgeable in seismic design
    - a. Hired under this Section of work
    - b. Cost of calculations borne under this Section
- C. Provide resilient restraining devices as required to prevent equipment motion in excess of 1/4 inch
- D. Coordinate seismic bracing requirements with other sections to result in
  - 1. Vertical pipe and duct restraints to coincide with and take place of required hangers
  - 2. Longitudinal pipe bracing to coincide with required pipe anchors
- E. Bracing shall not short circuit vibration isolation systems or transmit objectionable vibration or noise

### 3.07 VIBRATION ISOLATION

- A. Vibration isolation requirements shall be as required to meet sound and vibration design constraints. See Section 1.16C.
- B. Installation
  - 1. Install isolators and seismic restraints in accordance with manufacturer's written instructions
  - 2. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment
  - 3. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified
    - a. Electrical conduit connections to isolated equipment shall be flexible liquid tight conduit of sufficient length to incorporate a right angle bend, an offset of not less than 8 inches or a loop to allow free motion of isolated equipment.

- b. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.
- 4. Verify that all installed isolators and mounting systems permit equipment motion in all directions

### 3.08 CLEANING

- A. Thoroughly clean all equipment, ducts, etc. free of dust, scale, filings, plaster, grease, oil, paint and other construction debris.
- B. No construction materials, debris, dirt, etc. shall remain in any area planned for occupancy during construction during normal business hours. Clean up all areas prior to start of normal business hours.
- C. Water systems
  - 1. Closed Circuit Piping Systems
    - a. Open all valves (including control valves) in all legs so circulation goes through all sections.
    - b. Install temporary filter bags or fine-mesh start-up strainer screen in all line strainers during cleaning.
    - c. Fill with clean water.
    - d. Keep return isolation valve separating the central plant from the campus loop closed to prevent startup debris from migrating from the plant out to the campus; crack open supply isolation valve to provide a thermal expansion/contraction path for the mass of water in the building loop (applies after each loop filling). Bypass startup valve shall be open throughout cleaning procedure and closed immediately thereafter.
    - e. Start pumps and operate at design flow rate or greater.
    - f. Simultaneously drain at low points and fill the loop until effluent is clear.
    - g. Shut off makeup water.
    - h. Circulate for a minimum of two 48-hour periods. For each period:
      - 1) Add 4 lb. trisodium phosphate for each 1000 lb. of water in the system via pot feeder.
      - 2) At end of period
        - a) Shut the plant isolation valve.
        - b) Remove and clean strainers.
        - c) Drain at low points.
    - i. After last circulation period
      - 1) Shut off pumps.
      - 2) Shut the plant isolation valve.
      - 3) Completely drain out entire system of cleaning solution.
      - 4) Remove filters at strainers, or replace start-up screen with final strainer screen.
      - 5) Fill system with clean water.
      - 6) Start pumps, and simultaneously drain at low points for 8 hours.
      - 7) Test
        - a) Alkalinity not more than 200 parts per million in excess of alkalinity of rinsing water

- b) Effluent visually clear; no visible particles or color
- 8) Repeat flushing of water until tests are met.
- j. Connect the central plant to the campus distribution network.
  - 1) Open both the supply and return isolation valves to place the plant into service.
  - 2) Coordinate start of service with campus engineering so that central plant chemical dosing can be adjusted, if needed, to account for the new fluid added to the central plant.
  - 3) Do NOT leave the system filled with untreated water for more than 4 hours.
- 2. All open circuit systems shall be flushed until water runs clean.
- 3. Cooling Tower Passivation
  - a. Passivate all continuously wetted galvanized surfaces.
  - b. Water treatment supplier shall be responsible for providing passivation procedures and supervising passivation.
- D. Ducts
  - 1. Duct openings shall be sealed with plastic during construction to prevent debris buildup.
  - 2. Vacuum any visible debris from inside ducts, duct plenums and grille boxes.
  - 3. Use connected fan(s) to blow air through all duct systems until they are free of all foreign materials.

### 3.09 EQUIPMENT AND PIPING IDENTIFICATION

- A. Equipment
  - 1. All mechanical equipment shall be identified by nameplates securely fastened in a clearly visible location to the equipment housing or frame. Nameplates shall include the equipment design plan tag and brief description of service. Where starters or variable speed drives are provided under Division 23, provide additional nameplate indicating equipment tag mounted on starter face.
  - 2. Nameplates shall be 2-1/2" x 3/4" minimum, either 1/6" thick Bakelite with engraved white core letters and beveled edge, or aluminum with black enameled background and etched or engraved natural aluminum lettering.
  - 3. Manufacturer's nameplate shall be clean and legible and installed in a clearly visible location.
- B. Piping
  - 1. Identify piping with symbol identification (e.g. CWS) and direction of flow arrows, complying with ANSI A 13.1 color standards.
  - 2. Identify piping at approximately 25' centers where unconcealed Concealed piping above inaccessible ceilings shall be identified at each access panel. Concealed piping above accessible ceilings shall be identified within 10 feet of each wall penetration (both sides of walls).
  - 3. Where capped piping is provided for future connections, provide legible and durable metal tags indicating symbol identification.
  - 4. Printed labels with colored background and attaching strap: Seton, W. Brady, or equal.
- C. Valves: Tags not required.
- D. Warning Signs
  - 1. Provide warning signs at all equipment driven by electric motors which are controlled by fully automatic starters, General Industry Safety Orders.
  - 2. Provide refrigeration system labeling per code.

### 3.10 PAINTING

- A. Painting under this Section
  - 1. Black steel or PVC water piping exposed to outdoors
    - a. One coat primer
    - b. Two coat alkyd oil paint, color as indicated
  - 2. Interior of ductwork at air outlets as far back as visible from occupied spaces
    - a. Flat black
  - 3. Marred surfaces of factory painted equipment
    - a. Spot coat to match adjacent coat
- B. Execution
  - 1. Protect flooring and equipment with drip cloths
  - 2. Paint and materials stored in location where directed
  - 3. Oily rags and waste removed from building every night
  - 4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied
  - 5. Workmanship
    - a. No painting or finishing shall be done with:
      - 1) Dust laden air
      - 2) Unsuitable weather conditions
      - 3) Space temperature below 60 degrees F
    - b. Pipes painted containing no heat and remain cold until paint is dried
    - c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls or other defects
    - d. Finished surfaces shall be uniform in sheen, color, and texture
    - e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats
    - f. Priming undercoat of slightly different color for inspection purposes
  - 6. Piping continuously painted in all exposed areas
- C. Paint
  - 1. High gloss medium or long alkyd paint
  - 2. Best grade for its purpose
  - 3. Deliver in original sealed containers
  - 4. Apply in accordance with manufacturers instructions
- D. Colors
  - 1. Color coding as follows on Sherwin Williams, "Kem Lustral" or "Metalalistic II" name and figure numbers
    - a. Condenser water piping --- PALE GREEN, F65G42
  - 2. Interior of ductwork as far back as visible from outside: flat black
  - 3. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer
- E. Factory finish

1. Steel air outlets in ceilings: baked white enamel
  2. Bare aluminum air outlets: anodized
  3. Exposed fan coil units: baked enamel
  4. Unit ventilators and unit heaters: baked enamel
- F. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat

### 3.11 LEAKAGE TESTING

- A. Testing of hydronic systems: Pressure test piping at 1-1/2 times operating pressure, hold for one hour. No loss in pressure will be permitted. All leaks shall be repaired by tightening, rewelding or replacing pipe and fittings. Caulking of joints will not be permitted. Retest as required.
- B. Duct leakage testing
1. Not required.

### 3.12 VARIABLE SPEED DRIVES

- A. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each VSD with a copy to the Owner's Representative and a copy kept on file by the manufacturer. Start-up technician shall configure the VSD as follows:
1. Set minimum speed for all applications in accordance with procedure indicated in Division 25 Building Automation Systems.
  2. Enable current limit control and set maximum current limit setpoint to the motor to the motor's full load amps.
  3. Enable flying start feature.
  4. Set voltage to speed ratio (V/f) to "squared"
  5. Enable Flux Optimization capability.
  6. Set switching frequency:
    - a. Set to 4 kHz then check for motor noise in nearby occupiable spaces.
    - b. If motor noise is audible in occupied space, enable noise smoothing feature.
    - c. If noise is still a problem, raise switching frequency to 8 kHz. Do not raise switching frequency above 8 kHz.
  7. Configure status point to only indicate status when the drive detects a current above that which occurs when a belt is broken (fan), the rotor is locked, or a discharge damper or valve is fully closed.
  8. Set VSD to automatically restart with shortest time period allowed by VSD
    - a. After power is restored after a power interruption
    - b. After alarms are cleared
  9. For fans such as relief fans and cooling tower fans: Run fan through entire speed range and program out speeds that cause fan vibration.
  10. For VSDs powered by emergency generators, disable Under-volt Control (to cause the Pre-Charge Contactor to open as quickly as possible and prior to transfer of power, avoiding current surge and possible VFD damage).

- B. After VSD is fully configured and programmed, all settings shall be documented and included with commissioning documentation in electronic format per Section 230501 Basic Mechanical Materials and Methods. The intent is to allow replacement drive electronics to be readily configured.
- C. See Section 250000 Building Automation Systems for points to be mapped from the drive controller to the BAS; coordinate information addresses and other information required with the Division 25 Building Automation Systems contractor.

### 3.13 OPERATION OF SYSTEMS AND POST-CONSTRUCTION PURGE

- A. This section is provided to
  - 1. Minimize the possibility that ducts and air plenums will be contaminated with construction debris.
  - 2. Ensure that off-gassing volatile organic compounds (VOCs) are not transferred from one area to another.
  - 3. Purge VOCs that have off-gassed from construction materials and furnishings prior to occupancy.
- B. Construction Period
  - 1. Fan systems shall not be operated during construction (e.g. to assist in drying walls, space conditioning, etc.) unless approved in writing by Owner's representative.
- C. Test and Balance Period
  - 1. Operation of fan systems for test and balance shall only occur after the area served by air systems and all air plenums have been thoroughly cleaned of dust and debris. No construction work that generates dirt and particles shall be occurring while fan systems are in operation.
  - 2. Procedure
    - a. Install temporary construction filters (prefilters) on all supply air systems. Do not install high efficiency final filters at this time.
    - b. Adjust systems with economizer capability to supply 100% outdoor air, no recirculated air.
    - c. Perform test and balance work per Testing, Adjusting and Balancing herein.
    - d. Immediately prior to the start of the post-construction purge period (see below), remove and discard construction filters and install high efficiency final filters.
    - e. Conduct test and balance work at supply air system. System may be temporarily converted from 100% outdoor air to minimum outdoor air as required for tests only; return to 100% outdoor air configuration after tests.
- D. Post-Construction Purge Period
  - 1. Schedule
    - a. Start after
      - 1) All construction work that produces dust or VOCs is complete, except for minor touch-up painting work and installation of furnishings
      - 2) All test and balance work is complete on all air systems with 100% outdoor air capability
      - 3) Temperature control systems are operational
      - 4) Heating systems are fully operational
    - b. End after a time period determined from the following equation, calculated for each fan system individually, where T is time in days, A is the floor area served by the system in ft<sup>2</sup> and CFM is the outdoor air capacity of the system in cfm:

$$T = \frac{14000 * A}{CFM * 60 * 24}$$

- c. The space may only be occupied
  - 1) After the purge time period calculated above is complete; or
  - 2) After time T' calculated from the equation below provided the space is ventilated at minimum rate of 0.30 cfm/ft<sup>2</sup> of outside air or the design minimum outside air rate, whichever is greater, a minimum of three hours prior to occupancy and during occupancy until the purge time period calculated above is complete.

$$T' = \frac{3500 * A}{CFM * 60 * 24}$$

- 2. Procedure
  - a. Adjust systems with economizer capability to supply 100% outdoor air, no recirculated air.
  - b. Ensure that high efficiency final filters are in place.
  - c. Run fan systems supplying 100% outdoor air during entire purge period.
  - d. Enable boilers and zone controls and set heating setpoints to 70oF.
  - e. Cooling systems may be enabled or disabled.
- 3. Because final filters will not be challenged with contaminants in the return air, they do not have to be replaced after the flush-out period.

### 3.14 TESTING, ADJUSTING, AND BALANCING

- A. Test and adjust all items of heating, ventilating and air conditioning system to provide design conditions
  - 1. Testing, adjusting, and balancing shall be performed in complete accordance with AABC or NEBB National Standards for Field Measurements and Instrumentation as applicable to air distribution and hydronic systems.
  - 2. In general, systems shall be balanced so that one or more balancing valves/dampers remains wide open; if further flow reduction is required, fan or pump speed shall be reduced or impellers trimmed (in the case of pumps).
- B. Hydronic Systems
  - 1. Prepare water systems for balancing in following manner
    - a. Verify the following conditions
      - 1) Piping systems have been flushed and treated in accordance with Paragraph 3.08.
      - 2) Strainers have been cleaned
      - 3) Piping systems are completely full of water, all air properly vented
      - 4) All coil and heat exchanger shut-off, balance, and control valves are fully open
    - b. Check pump
      - 1) Rotation
      - 2) Pump factory impeller trimming by comparing shut-off heads with pump curves from approved submittals
        - a) Note that impellers on variable speed pumps should not be trimmed to design flow and head conditions.

- b) Report discrepancy in shut-off head to Owner's Representative and if impeller does not appear to be properly trimmed. Wait for direction before proceeding with pump test and balance.
  - c. BAS and Central Plant Operability
  - d. Do not proceed with any of the following balancing procedures until the BAS is capable of operating equipment such as fans, pumps, control valves, etc. in manual and automatic modes and capable of reading sensors such as differential pressure, flow rates, temperatures, etc. of air and hydronic systems to be tested and adjusted.
  - e. Do not proceed with fan-coil testing until chilled and hot water at design temperatures are available from the central plant.
2. Pumps
- a. Test and report for each pump at test conditions indicated in Paragraphs below.
    - 1) Tag
    - 2) Manufacturer and model of pump and motor
    - 3) Motor horsepower, volts, phase, full load amps
    - 4) Pump shut-off head from curves, measured shut-off head, and resulting impeller diameter from pump curve
    - 5) At test condition specified
      - a) Volts and amps
      - b) Calculated brake horsepower
      - c) Entering and leaving gage pressure and difference in feet
      - d) Flow rate deduced from pump curve
      - e) For pump with variable speed drive
        - 1. Speed (Hz)
        - 2. Kilowatts
  - b. Include pump curve from approved submittals in final report.
  - c. Under no circumstances shall valves at pumps be used for balance. All balance shall be done using valves at coils, chillers, and other devices served by the pumps.
3. Chilled Water Distribution Variable Speed Drive Setpoint Determination
- 1) Central Utility Plant secondary pumping system will use existing differential pressure setpoint as the Maximum Differential Pressure Setpoint.
  - 2) Verify BAS differential pressure reading matches handheld measurement when plant is enabled and chilled water pumps are in operation.
  - 3) Report at condition described above
    - a) BAS differential pressure reading and concurrent reading of handheld measurement.
    - b) Water flow rate through flow meter (where applicable), through BAS
4. Hot Water Distribution Variable Speed Drive Setpoint Determination
- 1) Central Utility Plant secondary pumping system will use existing differential pressure setpoint as the Maximum Differential Pressure Setpoint.

- 2) Verify BAS differential pressure reading matches handheld measurement when plant is enabled and hot water pumps are in operation.
  - 3) Report at condition described above
    - a) BAS differential pressure reading and concurrent reading of handheld measurement.
    - b) Water flow rate through flow meter (where applicable), through BAS
5. Fan Coil Test & Balance
- a. System is self-balancing. Two-way control valves at coils prevent each coil from being over-supplied with water, other than minor excursions during transients such as cool-down or warm-up. Conventional balancing (throttling of balancing valves) will increase pump energy use by not allowing aggressive differential pressure setpoint reset. Hence, do not adjust any valves on any coil or pump, except temporary adjustments where noted. Calibrated balancing valves may be provided for flow measurement and diagnostics but they shall not be modulated for flow balancing. Pressure independent valves shall be set to maximum flow rate of the valve, not the design flow rate. All manual valves at coils and pumps shall be wide open when test and balance work is complete.
  - b. Report with all control valves open to coil and all pumps (except standby pumps, where applicable) operating at full speed
    - 1) See Air Balance below for coil temperature data where required
    - 2) See Pump test data above for pump data
    - 3) Terminal tag
    - 4) Control valve model number and serial number
    - 5) Pressure drop across coil
    - 6) Flow as measured by calibrated balancing valve (where applicable). Where a calibrated balancing valve is not provided, determine flow by either of the following:
      - a) Use test plugs to measure pressure drop across the coil and estimate flow using coil manufacturer's submittal data of flow vs. pressure drop. This option shall only be used when design coil pressure exceeds 5 feet.
      - b) Use test plugs to measure pressure drop across the control valve and calculate flow using valve manufacturer's submitted Cv.
6. Chilled Water Plant
- a. Condenser Water Balance
    - 1) Determine chiller condenser flow using design differential pressure drop across condenser and manufacturer's design pressure drop from equipment submittals (do not use data on schedules).
    - 2) For each chiller stage, test and balance flow to condensers
      - a) Fully open valves at tower cells. (The towers will not be balanced.)
      - b) Fully open isolation valves at condenser.
      - c) Run appropriate number of CW pumps for the stage.
      - d) Adjust pump speed until flow rate at condensers is within 5% of design flow rate (deduced from pressure drop).
      - e) Do not adjust valve at pump discharge or isolation valve at chiller to balance flow.

3) Report

- a) See Pump test data above for pump data
  - b) For each chiller condenser
    - 1. Design flow rate and pressure drop.
    - 2. Measured inlet and outlet pressure and pressure drop and flow rate deduced from pressure drop from manufacturer's data.
    - 3. Condenser water pump speed (%)
- b. Evaporator Water Balance
- 1) Determine chiller flow using design differential pressure drop across evaporator and manufacturer's design pressure drop from equipment submittals (do not use data on schedules).
  - 2) Test and measure flow through chiller evaporators
    - a) Run all primary chilled water pumps (except stand-by pump, if any) at full speed.
    - b) Do not limit pump speed; it is acceptable if flow at 60 Hz exceeds design flow.
  - 3) Minimum speed correlation to minimum flow determination
    - a) For each chiller
      - 1. Open the control valve to the evaporator.
      - 2. Run one primary chilled water pump at full speed.
      - 3. Slowly lower the speed until the primary flowrate as measured by the primary loop flow meter equals the chiller's minimum flow rate.
      - 4. Note the pump VFD speed.
    - b) Both chillers operating in series
      - 1. Open the control valve to operate both chillers in series.
      - 2. Run one primary chilled water pump at full speed.
      - 3. Slowly lower the speed until the primary flowrate as measured by the primary loop flow meter equals the chillers' minimum flow rate.
      - 4. Note the pump VFD speed.
    - c) Both chillers operating in parallel
      - 1. Open the control valve to operate both chillers in parallel.
      - 2. Run one primary chilled water pump at full speed.
      - 3. Slowly lower the speed until the primary flowrate as measured by the primary loop flow meter equals the chillers' minimum flow rate.
      - 4. Note the pump VFD speed.
- 4) Report
- a) See Pump test data above for pump data
  - b) For each chiller evaporator
    - 1. Design flow rate and pressure drop.
    - 2. Measured inlet and outlet pressure and pressure drop and flow rate deduced from pressure drop from manufacturer's data.

- 5) Report and the minimum pump speed corresponding to the conditions listed below to the BAS installer
    1. Each chiller's minimum flow rate
    2. The minimum flow rate when both chillers are operating in series
    3. The minimum flow rate when both chillers are operating in parallel
  7. Hot Water Plant
    - a. Boiler Balancing
      - 1) Test and balance each boiler primary pump
        - a) Run primary pump.
      - 2) Report
        - a) See Pump test data above for pump data
        - b) Design and final flow rate at each boiler
        - c) Design and final inlet and outlet pressure at each boiler
- C. Air Systems
1. Air Outlets
    - a. Adjust diffusers' throw pattern prior to balance as indicated below unless otherwise indicated on Drawings. Review manufacturer's instructions for proper diffuser blade or weir gate positions to provide this throw pattern as it is not always intuitive. It is TAB contractor's responsibility to adjust throw patterns for all adjustable throw diffusers. If diffuser has a fixed throw pattern and is incorrectly installed, HVAC contractor shall correct pattern prior to balance.
      - 1) Ceiling diffusers: As indicated on the Drawings.
        - a) Star pattern diffuser deflectors shall be adjusted for corner blow pattern unless otherwise indicated on Drawings.
      - 2) Slot diffusers supplying cooling-only, or heating and cooling with ceilings 15 feet and lower: Adjust to throw away from adjacent walls along the ceiling toward the center of the room served.
      - 3) Slot diffusers supplying heating-only, or heating and cooling with ceiling above 15 feet: Adjust to throw downward and slightly toward adjacent wall.
      - 4) Double-deflection grilles: Adjust rear blades horizontal 22 degree upward and splay front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.
    - b. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements
      - 1) Start with all dampers wide open.
      - 2) Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face (if any) unless absolutely required.
      - 3) At least one damper shall remain wide open at end of balance.
    - c. Each grille, diffuser and register shall be identified as to locations and area. Size, type and manufacturer of diffusers, grilles, and registers shall be identified and listed. Readings and

tests of diffusers, grilles, and registers shall include design, initial test, and final adjusted FPM velocity and CFM.

2. Fan Coils
    - a. Minimum outdoor air
      - 1) Total air quantities for all fan-coil units shall be by duct traverse where possible as well as totaling the readings of individual air outlets.
      - 2) Minimum outside air quantities shall be established by pitot tube traverse of outside air duct or louver, or by deduction from pitot traverse of return air and supply air ducts.
      - 3) Balance by measurement of return air, outside air, and mixed air temperatures shall NOT be used due to inherent inaccuracy.
    - b. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed via speed potentiometer controlling ECM.
    - c. Test and adjust minimum outside air flow
      - 1) Supply air fan and return air fan (if any) shall first be operating at design airflow.
      - 2) Fully open the return air damper.
      - 3) Determine minimum outdoor air damper signals required to deliver design minimum outdoor airflow rate by adjusting the minimum damper signal through the BAS at the following conditions:
        - a) Design supply fan airflow and speed
        - b) 30 percent of design supply fan speed
      - 4) Convey the two minimum signals and associated fan speeds to the BAS installer and note on air balance report.
    - d. Test with system operating at minimum outside air flow condition described above and record the following on a schematic of the system
      - 1) Tag
      - 2) Manufacturer and model of fan and motor
      - 3) Sheave data at motor and fan; belt data
      - 4) Motor horsepower, rpm, volts, phase, FLA
      - 5) Fan airflow rate at all locations measured, as listed above
      - 6) Final measured amps
      - 7) Static pressures measured at
        - a) Mixed air plenum
        - b) Downstream of filter
        - c) Downstream of coil
        - d) Discharge of fan
      - 8) Concurrent airflow rate readings from BAS airflow sensors, where applicable
      - 9) Minimum OA damper position at design airflow
      - 10) Minimum OA damper position at 30% design airflow
- D. Provide upon completion of running tests, two (2) complete sets of data listed below for all items of equipment for incorporation in Owner's Operation and Maintenance Manual for the job

1. Name and address of testing agency and name of individual responsible for the work
2. Make, model and latest calibration date of testing equipment
3. Sketch or written description sufficient to identify individual devices tested
4. Final air quantities at each air outlet and inlet and maximum and minimum air flows for each fan coil unit
5. BAS setpoints
  - a. Variable flow hydronic system differential pressure
6. Entering and leaving water pressures, flow rates, and test temperatures at each piece of hydronic equipment
7. Manufacturer, size, model, serial number, motor hp, rpm, voltage, full load amps, vee belt sheave sizes, grooves, belts, sizes, length, starter heater size, rating and fuse size of each fan and pump.

### 3.15 COMMISSIONING

- A. Commissioning (Cx) activities shall be coordinated by a representative of the General Contractor who shall serve as the Commissioning Coordinator (CxC) as directed by a 3<sup>rd</sup> party Commissioning Provider (CxP) retained by the Owner.
- B. The commissioning responsibilities of the HVAC Contractor are as follows:
  1. Include requirements for submittal data, commissioning documentation, O&M data and training.
  2. Attend a commissioning scoping meeting, assist in commissioning schedule development and other meetings necessary to facilitate the Cx process.
  3. Attend regular commissioning meetings during the start-up, pre-functional test and functional test periods as scheduled by the General Contractor's commissioning coordinator.
  4. Assist and cooperate with the TAB contractor by putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
  5. Develop and complete pre-functional checklists and submit for review.
  6. Develop a full start-up and initial checkout plan and schedule using manufacturer's and specified start-up procedures for all commissioned equipment. Submit for review and approval prior to startup.
  7. Provide skilled technicians to execute starting and pre-functional testing of equipment, and to assist in executing functional performance tests and interpret the data, as necessary. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
  8. Provide all Title 24 Acceptance testing, including all documentation.
  9. Prepare an outline and schedule for training programs for approval.
  10. Include start up, pre-functional test documentation, and Operations and Maintenance Manual to CxP in electronic format.
- C. Title 24 Acceptance Testing
  1. Responsible Parties
    - a. Field Technician. Acceptance tests shall be conducted by a technician certified by an Acceptance Test Technician Certification Provider approved by the California Energy Commission. The Field Technician shall complete and sign all forms including the Certificate of Acceptance.



**SECTION 260000**  
**ELECTRICAL DESIGN CRITERIA**

**1.0 ELECTRICAL OVERVIEW**

1.1 Basis of Design includes:

- a. Electrical overview
- b. Electrical Distribution
- c. Grounding and bonding
- d. Mechanical HVAC, plumbing and fire protection
- e. Wiring devices, branch circuiting and miscellaneous equipment
- f. Lighting system and controls
- g. Fire alarm system
- h. Field quality control

1.2 Project summary:

- a. General:
  1. Project will be built using the design-build approach.
  2. Design of project shall conform to this document, Electrical Drawings, Owner's Requirements, and bid instructions prepared by General Contractor.
  3. Materials and installation shall conform to the Basis of Design, Division 26 – Electrical.
  4. Additionally, the design shall utilize preliminary Architectural, Structural, Civil, Drawings, as well as HVAC and Plumbing drawings, Basis of Design and/or Specifications for coordination purposes with other trades.
- b. Project description:
  1. The project consists of renovating the Laney College central utility plant located in Oakland, California. The project is limited to the following scope:
    - a) Providing and/or modify electrical connections for retrofitting the existing central utility plant at the Laney College Campus in Oakland, CA.
      - 1) The scope of work for this bid includes the chilled and hot water plant equipment located in Building E that provides heating and cooling to all buildings on campus. In addition, the existing cooling towers will be demolished and relocated to a new enclosure south of Building F.
    - b) Electrical Central Utility Plant space and connection pathways for the Laney College Library and Learning Resource Center building replacement
      - 1) Space and conduit pathway for new high fire point liquid filled pad mounted transformer 12.47KV PRI, 277/480VOLT, 3 PHASE, 4 WIRE SECONDARY, 1500 KVA transformer specified and provided in the Library and Resource center project.
      - 2) Space and conduit for a new 200 kW Generator specified and provided in the Library and Resource center project.

- c) Power, lighting and fire alarm connections for new Central Utility Plant building for mechanical equipment, electrical equipment and storage. Refer to architectural plans.
- d) Reroute existing electrical feeders as shown on the Civil drawings.
- e) Reroute existing site lighting circuits routed through site work to be demolished for the new Library and learning back to the Central Utility Plant
2. Electrical features shall consist of the following:
  - a) Normal power distribution system
  - b) Service grounding, power system and distribution grounding, equipment bonding
  - c) Power connections to all motors to include equipment for HVAC, plumbing, etc.
  - d) Power connections to all owner furnished equipment
  - e) Wiring devices and associated branch circuiting
  - f) Interior and exterior lighting systems
  - g) Emergency and egress lighting system
  - h) Lighting control system per requirements of Title 24
  - i) Lighting branch circuiting
  - j) Fire alarm system
- c. Bid documents:
  1. General:
    - a) The components of the electrical design-build bid package include the following:
      - 1) Electrical Drawings
      - 2) Electrical Basis of Design
    - b) A copy of the preliminary architectural, structural, civil, etc. drawings have been provided the electrical contractors to assist in developing bid pricing.
    - c) A copy of the design-building bid packages for HVAC, plumbing, and fire protection have also been provided the electrical contractors to assist in developing bid pricing.
    - d) Instructions to Bidder's, developed by the General Contractor, have also be provided.
  2. Electrical Drawings: The purposes of the Electrical Drawings are to provide an overview of the power distribution system with equipment and feeders, general layout information for the electrical system equipment, entrance locations for utility services, riser diagrams, etc. Drawings are generally at a 100% Schematic design development level of completeness, so not everything has been shown and assumptions will need to be made.
  3. Electrical Basis of Design: The purpose of the Basis of Design is to cover in written format what is not shown on the electrical drawings and to establish performance criteria for the electrical systems, which should be the basis of the electrical design. As part of the Basis of Design we have included an Interface/ Responsibility Matrix at the end of this Section.

### 1.3 Design-Build approach:

- a. Design-Build overview:
  1. The work for this project will be built using a "Design-Build" approach. The Design-Build contractor ("EOR/Contractor") and The Engineering Enterprise ("Electrical Designer") shall have responsibilities as indicated herein.
  2. The Design-Build process requires the EOR/Contractor to participate as a team member with other Design Consultants within other disciplines. This is not a conventional 'Plan & Spec' project.

3. Bid documents are at a 100% Schematic Design development level of completeness and are primarily, intended to establish scope. These documents are not complete and should not be viewed as construction documents. Prior to bid, the EOR/Contractor shall perform an engineering review of the bid documents and include in their pricing all work, whether shown or not, required for a complete and operational electrical system.
4. The engineer or project manager representing the EOR/Contractor shall participate in regular design and construction meetings, from the award of contract through the end of construction.
5. The EOR/Contractor shall provide engineering services during the development of the construction documents and this engineering service capability shall be a significant factor in the bid selection process.
6. The EOR/Contractor shall be the Engineer-of-Record for the project, stamping and signing the drawings prior to permit submission.
7. Once the EOR/Contractor has been selected, Revit and/or CAD files of the 100% Schematic Design development drawings will be provided to them for preparation of the construction documents.
8. The table below indicates responsibility assignments for the EOR/Contractor and the Electrical Designer.

Item	EOR/Contractor	Electrical Designer
Electrical Engineer-of-Record	P	N
Design and construction meetings	P	S
Load calculations	P	R
Final equipment sizing	P	R
Equipment selection	P	R
Construction details	P	R
Seismic restraints	P	R
Coordination with other trades	P	S
Preparation of 100% construction drawings	P	R
Title 24 lighting calculations & forms	P	R
Preparation of electrical specifications	R	P
Review of construction document drawings	S	P
Shop drawings and submittals	P	R
Project construction management	P	N
Construction and all field work	P	R
Construction quality control	P	R
Start-up & testing	P	R
Training	P	N

9. Explanatory notes:
  - a) Primary (P) responsibility shall mean making all decisions and taking responsibility for the item.
  - b) Secondary (S) responsibility shall mean taking an active role assisting the party with primary responsibility for the item.
  - c) Review (R) shall mean that the party shall review and comment on the work done by the party with primary responsibility for the item.

- d) No (N) responsibility shall mean the party will have no role regarding the item.
- 10. The following parties will participate in the coordination and preparation of the electrical construction drawings:
  - a) Major equipment suppliers for power distribution equipment, emergency generators, etc.
  - b) Special system suppliers for lighting controls, sub-metering, etc.
  - c) Fire alarm system suppliers.
- b. Engineering and design:
  - 1. Coordination:
    - a) Contractor's engineers and designers shall coordinate all aspects of the electrical systems with the Architect and all other trade disciplines that require electrical interface.
    - b) Review all proposed lighting fixtures with the Architect prior to proceeding with detailed calculations, layouts and circuiting.
    - c) Review finishes of all electrical devices, coverplates, etc., with the Architect.
    - d) Coordinate all conduit routing, equipment room layouts, risers, penetrations, etc., with the Architect and other trade disciplines.
    - e) Attend design coordination meetings with Owner Representative, Architect, General Contractor and other trade disciplines to coordinate the design of the electrical system and obtain information related to Division 26 work.
    - f) Cooperate with other Designers and Contractors to verify the proper locations and circuit configurations for equipment provided by other Divisions of work requiring electrical service connections.
  - 2. Construction documents:
    - a) Upon award of bid, the successful EOR/Contractor shall immediately precede with the preparation of the construction documents for review and approval by the Owner.
    - b) The final design shall fully coordinate all architectural, structural, HVAC, plumbing, fire protection, landscape, civil, etc., elements of the project.
    - c) The drawings shall be prepared and stamped by a California registered Professional Electrical Engineer, employed or retained by the Electrical Contractor.
    - d) The construction document package shall contain drawings prepared in Revit or AutoCad format, which include the following to clearly describe and detail the proposed work:
      - 1) Symbols list
      - 2) General and/or numbered notes
      - 3) Schedules:
        - (a) Fixture schedule
        - (b) Feeder schedule
        - (c) Panelboard schedules
        - (d) Lighting control schedules
        - (e) Miscellaneous control schedules, as required
      - 4) Title 24 lighting compliance forms as required
      - 5) Floor plans locating all lighting fixtures and control devices, to include branch circuiting
      - 6) Floor plans locating all power devices, mechanical equipment, Owner furnished equipment, etc., to include branch circuiting and power connections.
      - 7) Enlarged scale plans of heavily congested areas (minimum 1/4" to 1/2" scale).

- 8) Equipment layouts of all electrical rooms, etc. (minimum 1/4" to 1/2" scale).
  - 9) Proposed routing of all conduits 2" and larger
  - 10) Normal power riser diagram
  - 11) Power system grounding riser diagrams
  - 12) Electrical details as required.
- e) The package shall also contain all calculations required by the Building Inspection Department, but as a minimum shall include the following:
- 1) Panelboard connected load summary schedule
  - 2) Voltage-drop calculations
  - 3) Short circuit calculations
  - 4) Feeder and service load calculations
  - 5) Lighting calculations
  - 6) All Title 24 compliance forms
- f) Construction documents are required to be prepared in Revit and shall meet the following requirements:
- 1) All Construction Document (CD) drawings shall be created using the latest version of Revit.
  - 2) Design shall be coordinated with architecture and structure at the start of the CD phase. Detailed clash detection shall occur at the 50% CD issuance.
  - 3) Final CD drawings shall be Level of Development (LOD) 350.
  - 4) Shop drawings and as-built model shall be LOD 350.
3. Design review:
- a) The EOR/Contractor shall submit their construction document package for progress review by the Owner at specified intervals within the design process. Assume the submissions will be at the 100% Design Development Phase, plus 75% and 95% Construction Document Phase.
  - b) Upon receipt of the construction documents at each of the review stages, the Owner and Architect will review the package and notify the EOR/Contractor regarding any proposed changes.
  - c) When the construction documents are complete and review comments implemented, the final design package shall be submitted to the Building Department for plan check and permit. The package shall include drawings, all calculations, back-up information, and documentation or additional drawings as required to obtain the Building Permit. The EOR/Contractor shall make any changes requested by the Building Department and resubmit the package for back-check.
  - d) The EOR/Contractor shall, within thirty (30) days of completion of construction documents, provide detailed shop drawings and submittals for all electrical equipment.

#### 1.4 Value engineering:

- a. Value engineering 'VE' is an integral part of the design-build process taking advantage of the Contractors breath of experience and expertise.
- b. The bid documents establish the base bid for contractors pricing on this project, so that apples-to-apples comparisons can be made between bidding contractors. Where a contractor sees opportunities for VE, they shall prepare and submit their ideas with their bid proposal, listing each item for the Owners consideration. Each item shall be described in enough detail to accurately convey the Contractors proposal and shall be accompanied by a lump sum value amount that if accepted would be deducted from the base bid amount.

- c. No VE items shall be applied directly to the Contractors base bid amount.

1.5 Permits and fees:

- a. Provide all necessary notices, obtain all permits and pay all government taxes, and other costs in connection with this work.
- b. Obtain all required certificates of inspection for this work and deliver same to the Owner before request for acceptance and final payment for the work.

**2.0 ELECTRICAL DISTRIBUTION**

- 2.1 The bid documents have included a scheme in the form of Power Riser Diagram(s) for the electrical distribution system, which represents the Designer's best assumptions at this stage of the project. The EOR/Contractor is not limited to this scheme, if they have a more cost-effective approach. The preference is for the EOR/Contractor to price the bid document scheme as part of their base bid cost and present their alternate scheme as a value engineering approach. In this alternate approach, all design parameters outlined herein, as well as that addressed by Code, shall be met. The EOR/Contractor shall submit their scheme in the form of a Power Riser Diagram with load calculations and value engineering savings, along with their bid proposal.
- 2.2 The electrical drawings include load calculations for the buildings, which is the basis for sizing of the electrical service and distribution system throughout the building/facility. The EOR/Contractor shall revisit the calculations as the design progress through construction documents and update the calculations as system change.
- 2.3 Refer to the floor plan drawings for locations of electrical rooms that house the power distribution equipment. Determine if there is sufficient space for equipment and equipment clearances to house the required system as outlined in the Power Riser Diagram.
- 2.4 Distribution equipment:
  - a. The electrical equipment forming the distribution system has all been sized on the Power Riser Diagram(s), indicating ampacity, voltage, phase and wire quantity ratings. EOR/Contractor shall verify these ratings and shall provide equipment with enough space for overcurrent devices required to accommodate connections, as well as space to accommodate the possibility of future connections, i.e. 25% spare space as a minimum.
- 2.5 Central battery inverter system:
  - a. Central battery inverter system for powering the emergency egress lighting system and exit signs, upon loss of utility power, for 90-minutes of backup power.
  - b. Central battery inverter system for powering the utility building pumps, upon loss of utility power, for 90-minutes of backup power.
  - c. The inverter shall be rated at 20 kva with an input voltage of 480volt, 3-phase, 3-wire with an output voltage of 277/480volt, 3-phase, 4-wire.

### **3.0 GROUNDING AND BONDING**

#### 3.1 System description:

- a. Provide for the grounding and bonding of all electrical apparatus, machinery, appliances, building components, fittings and accessories where required to provide a permanent, continuous, low impedance, grounded electrical system.
- b. Provide grounding for all separately derived system neutrals.
- c. Include supplemental grounding electrodes as required for separately derived system grounding.
- d. The complete electrical installation including the neutral conductor, metallic conduits and raceways, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements.

#### 3.2 Requirements:

- b. An insulated ground conductor shall be installed in the following:
  1. All feeders
  2. All branch circuit wiring runs
- c. Provide separately derived system grounding for all transformers and generator.
- d. For concrete building structures, provide a separate power system grounding riser with wall mounted ground bus bars in all electrical rooms and interconnecting ground riser conductor between each. At level where main electrical room occurs, provide a grounding conductor connection between the riser bus bars and the main electrical ground bus bar.

### **4.0 MECHANICAL HVAC AND PLUMBING**

4.1 The HVAC and plumbing systems bid documents are an integral part of this Division 26 package and as such shall be viewed inclusive in all respects as it relates to the electrical connection of Divisions 21, 22, 23 and 25 equipment. The Contractor shall review these documents for equipment electrical characteristics; i.e. sizes in load, voltage, phase, etc., as well as equipment locations.

4.2 The electrical documents indicate connection requirements for the major Divisions 21, 22 and 23 equipment, but are not all-inclusive. The Contractor shall determine all other mechanical equipment not shown in the electrical documents, but still requiring electrical connections and make provisions to include in pricing.

#### 4.3 HVAC and controls systems:

- a. The following is a schedule of the major HVAC system equipment at the time of bid document preparation. This does not alleviate the Contractor from doing a thorough review of the mechanical system schematic design package for additional information. Also, as the design progress through to final construction documents, loads and equipment may change somewhat:

<b>Equipment</b>	<b>Load</b>	<b>Voltage</b>	<b>Starter/ VFD by M/E</b>	<b>Emerg Power Y/N</b>	<b>Location</b>
Chiller CH-1	381 FLA	480v, 3ph, 3w	M (VFD)	N	CUP
Chiller CH-2	381 FLA	480v, 3ph, 3w	M (VFD)	N	CUP
Cooling Tower CT-1	15hp	480v, 3ph, 3w	M (VFD)	N	Utility Building
Cooling Tower CT-2	15hp	480v, 3ph, 3w	M (VFD)	N	Utility Building
Fan Coil FC-1	1/7hp	208v, 3ph, 3w	E	N	CUP
Fan Coil FC-2	1/6hp	208v, 3ph, 3w	E	N	CUP
Transfer Fan TF-1	1hp	208v, 3ph, 3w	E	N	CUP
Boiler B-1	18 FLA	208v, 3ph, 3w	E	N	CUP
Boiler B-2	18 FLA	208v, 3ph, 3w	E	N	CUP
Boiler B-3	18 FLA	208v, 3ph, 3w	E	N	CUP
Boiler B-4	18 FLA	208v, 3ph, 3w	E	N	CUP
Primary Chilled Water PCHP-1	10hp	480v, 3ph, 3w	M (VFD)	N	CUP
Primary Chilled Water PCHP-2	10hp	480v, 3ph, 3w	M (VFD)	N	CUP
Secondary Chilled Water SCHP-1	50hp	480v, 3ph, 3w	M (VFD)	N	CUP
Secondary Chilled Water SCHP-2	50hp	480v, 3ph, 3w	M (VFD)	N	CUP
Primary Hot Water PHWP-1	7.5hp	480v, 3ph, 3w	M (VFD)	N	CUP
Primary Hot Water PHWP-2	7.5hp	480v, 3ph, 3w	M (VFD)	N	CUP
Primary Hot Water PHWP-3	7.5hp	480v, 3ph, 3w	M (VFD)	N	CUP
Primary Hot Water PHWP-4	7.5hp	480v, 3ph, 3w	M (VFD)	N	CUP
Secondary Hot Water SHWP-1	20hp	480v, 3ph, 3w	M (VFD)	N	CUP
Secondary Hot Water SHWP-2	20hp	480v, 3ph, 3w	M (VFD)	N	CUP
Building E Territory Hot Water THWP-1	5hp	480v, 3ph, 3w	M (VFD)	N	CUP
Building E Territory Hot Water THWP-2	5hp	480v, 3ph, 3w	M (VFD)	N	CUP
Condenser Water CW-1	20hp	480v, 3ph, 3w	M (VFD)	N	CUP
Condenser Water CW-2	20hp	480v, 3ph, 3w	M (VFD)	N	CUP
Water Treatment System WTS-1	15amp	120v, 1ph, 2w	E	N	CUP

Equipment	Load	Voltage	Starter/ VFD by M/E	Emerg Power Y/N	Location
Air Compressor AC-1	25hp	480v, 3ph, 3w	M (VFD)	N	CUP
Compressed Air Dryer D-1	15amp	120v, 1ph, 2w	E	N	CUP
TCP-3	15amp	120v, 1ph, 2w	E	N	CUP

- b. The fourth column above indicates which of the subcontractors will be furnishing the starters and/or VFDs. “M” means mechanical subcontractor and “E” means electrical subcontractor. Installation of this equipment will be by the electrical subcontractor, unless equipment is furnished as a package and pre-mounted by equipment vendors.
- c. The fifth column above indicates whether the equipment is served by emergency power source or not. “Y” is for yes and “N” is for no.
- d. The electrical contractor shall furnish and install local service disconnect switches at every piece of equipment listed above. Although, where VFDs are provided by the mechanical subcontractor, the VFDs shall contain an integral disconnecting means and if located within sight of equipment, a local disconnect would not be required.
- e. Additional HVAC equipment requirements:
  1. HVAC system temperature control panels: Provide a 20amp, 120volt dedicated circuit connection to each temperature control panel. Assume there will be a temperature control panel in each electrical room on every level of the building. Also, assume three TCP’s in the mechanical penthouse level.

4.4 Plumbing systems:

- a. The following is a schedule of the major plumbing system equipment at the time of bid document preparation. This does not alleviate the Contractor from doing a thorough review of the plumbing system bid package for additional information:

Equipment	Load	Voltage	Starter/ VFD by P/E	Emerg Power Y/N	Location
SE-1A	3HP	480v, 3ph, 3w	M (VFD)	Y	UTILITY
SE-1B	3HP	480v, 3ph, 3w	M (VFD)	Y	UTILITY
SDP-1A	2HP	480v, 3ph, 3w	M (VFD)	Y	UTILITY
SDP-1B	2HP	480v, 3ph, 3w	M (VFD)	Y	UTILITY

- b. The fourth column above indicates which subcontractor will be furnishing the starters and/or VFDs. “P” is for plumbing and “E” is for electrical. Installation of this equipment will be by the plumbing subcontractor, unless otherwise noted.
- c. The fifth column above indicates whether the equipment is served by emergency power source or not. “Y” is for yes and “N” is for no.

- d. The electrical contractor shall furnish and install local service disconnect switches at every piece of equipment listed above.
- e. Additionally, for the fire protection system, there will be a need to make fire alarm system connections at the fire pump for monitoring purposes, each sprinkler flow switches, and each sprinkler tamper switch. These connections are covered under the fire alarm/life safety system section.

## **5.0 WIRING DEVICES, BRANCH CIRCUITING AND MISCELLANEOUS EQUIPMENT**

### **5.1 Lighting branch circuiting:**

- a. The interior lighting system shall be circuited utilizing conduit and wire in open ceiling spaces.
- b. No lighting circuit shall be loaded over 75% of circuit breaker capacity.
- c. Hardwire homeruns shall utilize #10awg conductors as a minimum.
- d. Emergency/egress lighting circuits shall be wired completely independent of all other circuiting.

### **5.2 Wiring device branch circuiting:**

- a. Wiring devices shall be circuited utilizing conduit and wire in all open ceiling spaces and MC cable in concealed ceiling spaces or walls. Where MC cable is used, all homeruns shall be conduit and wire.
- b. Connect a maximum of six (6) receptacles per 20amp, 120volt circuit.
- c. Hardwire homeruns shall utilize #10awg conductors as a minimum.
- d. Provided dedicated circuits to receptacles where noted.
- e. Provided hardwired homeruns from each specialty outlet.
- f. Where homeruns share neutral conductors, handle ties shall be used at the breakers.

### **5.3 Wiring devices:**

- a. Specification grade, 20 amp rated devices shall be used exclusively, unless indicated otherwise.
- b. Device colors shall be as follows, unless otherwise noted by the architect:
  - 1. Standard normal power wiring devices shall be white in color.
  - 2. Emergency power wiring devices shall be red in color.
- c. All GFCI type receptacles shall be standalone, not feed through type.
- d. All receptacles installed outside shall be GFCI type with weatherproof while in use style covers.

### **5.4 Mechanical, electrical and plumbing rooms:**

- a. Provide a duplex receptacle on every wall of each mechanical/plumbing/fire protection room and within sight of every piece of equipment. If more devices are required to maintain the "within sight" condition, then add more devices as necessary.

- b. Provide a duplex receptacle on each wall of the main electrical rooms, or a minimum of 20' on center along the walls, whichever is greater.
- c. Provide one wall mounted duplex receptacle in each satellite electrical room.
- d. Connect a maximum of six (6) devices per 20amp, 120volt circuit.

5.5 Storage rooms: Provide a minimum of one (1) duplex receptacle for every storage room. If the room is larger than 200 square feet, provide two (2) duplex receptacles.

**6.0 LIGHTING SYSTEM AND CONTROLS**

6.1 Lighting system:

- a. Provide a complete interior and exterior, normal and emergency/egress lighting system consisting of fixtures, lamps, LEDs, ballasts, drivers, transformers and controls. Fixtures shall be securely attached to support system to meet all seismic code requirements.
- b. Lighting components, energy consumption and controls shall conform to the California Energy Efficiency Standards, Title 24.
- c. Refer to the drawings for typical lighting fixture layout and quantities, and the Luminaire Schedule for lighting fixture types, which should form the basis of Contractor's bid price.
- d. The lighting fixture selection and quantity identified in the bid documents meet the requirements of the illumination levels in the schedule below. The Contractor shall be responsible for providing lighting level calculations of the core & shell spaces at the completion of the design development stage, to identify any space that is either under or over illuminated, so that adjustments can be made prior to proceeding with construction documents.
- e. Illumination levels:

Area Served	Average Maintained Foot-Candle Levels
Storage	15 to 20
Elec., Mech. & Elev. Equipment Rooms	30 to 40

6.2 Emergency/egress lighting requirements:

- a. Contractor shall select the appropriate quantity of fixtures to be on emergency power to provide 1fc average in egress pathways
- b. Contractor shall provide all exit signs as required for Code compliance and in accordance with the Architect's egress plan for the complete project.

6.3 Lighting controls:

- a. Interior common area control system:
  - 1. A digital lighting control system that provides controls for interior and exterior lighting fixtures. The system shall interconnect stand-alone components such as drivers, electronic dimming and non-dimming ballasts, photocell, occupancy sensors, switches, etc., as well as analog lighting controls to provide a complete stand-alone room/area control system. Control devices shall interconnect either by communication type cables or shall employ a wireless technology.

2. The system shall be a centralized addressable system to include the following control options:
  - a) On/off/dim control via local low-voltage switches
  - b) Automatic/manual on and automatic/manual off via occupancy sensor and low voltage switch
  - c) Astronomical time schedule control through the central headend.
3. Controls by areas:
  - a) Corridors/circulation:
    - 1) Shall be controlled by occupancy sensors to reduce normal and emergency lighting levels down to 50% when no occupancy is present. Occupancy sensors shall be set to be automatic on to 100%.
  - b) Electrical and mechanical rooms: Shall be controlled by local line voltage toggle switches to allow for bi-level control. These rooms shall not be tied into the lighting control system.
  - c) Other interior spaces:
    - 1) Shall be controlled by occupancy sensors for on/off control.
    - 2) Provide daylight harvesting photocells as required by 2019 Title 24.
    - 3) Provide manual dimming controls to give the user adjustability of the light fixtures.
- b. Exterior lighting control system:
  1. All exterior lighting shall be controlled with a lighting relay control panel for on/off control via photocells and an astronomical time clock schedule to turn off lighting during daylight hours.
  2. Wall mounted fixtures mounted under 24' and rated over 30 watts and pole mounted fixtures under 24' and rated over 75 watts shall be controlled with a standalone integral occupancy sensor that shall automatically reduce lighting between 40 and 80% when no occupancy is present. Sensors shall be automatic on to 100%.

## **7.0 FIRE ALARM SYSTEM**

### 7.1 System shall include:

- a. Initiating devices
- b. Notification appliances
- c. Auxiliary equipment controls and supervision

### 7.2 System description:

- a. Provide a Code compliant fire alarm system to conform with the existing Simplex Fire Alarm system, Electrical Specification and as outlined herein in this Electrical Basis of Design document, as a minimum requirement. In general:
  1. The Drawings provide floor plans of building space where some, not all, of the initiating and notification appliances have be shown.
  2. The Specifications cover the material and performance requirements of the system
  3. The Electrical Basis of Design covers the application.

### 7.3 Fire alarm system equipment:

- a. Initiating devices (minimums):
  1. Manual pull stations: One at the main control panel location
  2. Smoke detectors:
    - a) Minimum of one in every electrical and telecommunication equipment room. Additional devices will be required if room exceeds 900 square feet in area or where beam pockets necessitate additional coverage.
    - b) One at each return air fire/smoke damper 36" wide or less or two if over 36" and under 72" wide or three if over 72" and under 108" wide. None are required if area served by FSD has full coverage smoke detection, such as elevator lobbies, electrical or telecommunication rooms, etc.
    - c) One at the FACP location and where FATCs are located, if not already being provided by conditions outlined above, i.e. electrical rooms and telecommunication rooms
- b. Fire alarm notification system:
  1. Individual horn and strobe appliances or combination appliances, including both, will be installed throughout the building to allow them to be easily heard and seen per the requirements of Code. The operation of these appliances will occur upon activation of any sprinkler flow switch, manual pull station, or smoke detection. The system will be set up in such a manner to allow for voice messages to override the "whoop" sound via the microphones at the FCC.
  2. Locations:
    - a) Full coverage throughout the entire core/shell portion of the facility per NFPA 72, to include:
      - 1) Service corridors, receiving and loading dock area
      - 2) Equipment rooms
- c. Remote Central Station: The following summary alarm conditions will be transmitted to a UL approved remote central station facility via leased telephone lines:
  1. Smoke detection system alarms
  2. Sprinkler flow alarm
  3. Activation of any manual pull station
  4. Trouble

## **8.0 FIELD QUALITY CONTROL**

### **8.1 General:**

- a. Perform tests to prove installation is in accordance with contract requirements. Perform tests in presence of the Owner's representative and furnish test equipment, facilities and technical personnel required to perform tests. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.
- b. 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.

- c. Include all test results in the maintenance manual. Cost, if any, for all tests shall be paid by the Contractor.
- d. After other work such as sanding, painting, etc. has been completed, clean lighting fixtures, panelboards, switchboards and other electrical equipment to remove dust, dirt, grease or other marks. Leave work in clean condition.
- e. Voltage check:
  - 1. 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.
  - 2. Adjust taps on transformers to give proper voltage, which is 118 to 122 volts for 120 volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.

## 8.2 Project close-out:

- a. Training: At the time of completion, a period of not less than 24 hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 24 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.
- b. Special tools: Provide one of each type of tool 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 ELECTRICAL BASIS OF DESIGN**

## **SECTION 31 20 00 - EARTHWORK**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Specifications for the excavation, filling, recompacting, grading and disposal of excess material.

#### **1.2 RELATED SECTIONS**

- A. Section 31 23 19 – Dewatering
- B. Section 31 23 33 – Trenching and Backfilling

#### **1.3 REFERENCES**

- A. ASTM C136-84a – Standard Method for Sieve Analysis of Fine and Coarse Aggregate
- B. ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort
- C. ASTM D2922 – Density of Soil and Soil-Aggregate in Place by Nuclear Methods
- D. Caltrans – State of California Standard Specifications, latest edition
- E. Geotechnical Report – “Geotechnical Investigation and Geologic Hazard Evaluation for Laney College Library Learning Resource Center” prepared by Fugro, dated February 28, 2020

#### **1.4 DEFINITIONS**

- A. Compaction
  - 1. The degree of compaction is specified as percent compaction. Maximum densities refer to the maximum laboratory dry soil densities obtainable at optimum moisture content as determined by ASTM D1557.
  - 2. Percent compaction (relative compaction) is the ratio of the measured field dry density to the laboratory maximum dry density.
- B. Excavation Slope: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.

#### **1.5 SUBMITTALS**

- A. Product Data
  - 1. Fill materials
  - 2. Source of concrete and aggregate for approval
  - 3. Materials (sieve analysis, source, gradation) and procedure for lime

4. Submit the name of the lime stabilization subcontractor and written documentation summarizing the qualifications for the firm and the references for five similar projects. Provide qualifications detailing the experience of the lime stabilization superintendent in the supervision of the lime stabilization work.

B. Test Reports

1. Gradation (ASTM C136)
2. Density-In-Place (ASTM D2922)
3. Soil Contamination Testing

## **PART 2 PRODUCTS**

### **2.1 FILL MATERIALS**

- A. Class 2 Aggregate Base - Use of native material is allowed only when written approval from the Geotechnical Engineer has been given.
1. Class 2 aggregate base for subsequent backfill and/or pavement base to be  $\frac{3}{4}$  inches maximum Class 2 aggregate base conforming to Caltrans, Section 26. Class 2 aggregate base material shall have a minimum R-Value of 78.
  2. Materials specifications and procedures shall conform to Caltrans Standard Specifications, latest edition, except 95% relative compaction based on maximum dry density (ASTM 1557) instead of Caltrans Test Method 216 should be obtained in the baserock (and the subbase if used) and in the upper six inches of soil subgrade.
  3. Classification of Fill - 95% Relative Compaction - Class 2 Aggregate Base.
- B. Native Backfill - Use of native material is allowed only when written approval from the Geotechnical Engineer has been given.

**END OF SECTION**

## **SECTION 31 23 19 – DEWATERING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Specifications and procedure for the dewatering of excavations and disposal of water.

#### **1.02 SUBMITTALS**

- A. Prior to installation of the dewatering system, submit shop drawings and design data indicating the following:
  - 1. The proposed type of dewatering system
  - 2. Arrangement, location and depths of system components
  - 3. Complete description of equipment and instrumentation to be used, with installation, operation and maintenance procedures
  - 4. Methods of disposal of pumped water
  - 5. Necessary permits for water disposal

### **PART 2 PRODUCTS**

#### **2.01 EQUIPMENT**

- A. Furnish all materials, tools, equipment, facilities, and services as required for providing the necessary dewatering work and facilities.
- B. Provide backup equipment as necessary for the replacement and for unanticipated emergencies.

**END OF SECTION**

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## **SECTION 31 23 33 - TRENCHING AND BACKFILLING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Specifications for excavating, backfilling and compacting for the installation of pipe and pipeline appurtenances (i.e. manholes, catch basins, area drains, etc.)

#### **1.02 SUBMITTALS**

- A. Product Data: Provide general construction, electrical equipment, and component connections and details.
- B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

#### **1.03 RELATED SECTIONS**

- A. Section 31 20 00 – Earthmoving
- B. Section 31 23 19 - De-watering
- C. Section 32 11 23 - Aggregate Base

#### **1.04 REFERENCES**

- A. AT&T Standard Specifications - Latest Edition
- B. California Plumbing Code - Latest Edition
- C. Alameda County Standard Plans – Latest Edition
- D. PG&E Greenbook – Latest Edition

### **PART 2 PRODUCTS**

#### **2.01 BACKFILL MATERIAL**

- A. Trench backfill shall consist of lightweight fill with a maximum unit weight of 65 pounds per cubic foot, minimum Durability Index of 35 (California Test 229), minimum R-Value of 50 (California Test 301) to minimize new loads and the potential for settlement in deep trenches. The Geotechnical Engineer shall approve use of class II aggregate base. Trench backfill shall meet the requirements listed in the Geotechnical Report

#### **2.02 PIPING MATERIAL**

- A. All piping material shall conform to the California Plumbing Code.

#### **2.04 BURIED WARNING AND IDENTIFICATION TAPE**

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, 'CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes.  
  
Red: Electric.  
Yellow: Gas, Oil; Dangerous Materials.  
Orange: Telephone and Other Communications.  
Blue: Water Systems.  
Green: Sewer Systems.
  2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
  3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3-feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

#### **2.04 DETECTION WIRE FOR NON-METALLIC PIPING**

- A. Detection wire shall be insulated single strand, solid copper wire with a minimum of 12 AWG.

**END OF SECTION**

## **SECTION 31 25 13 – EROSION CONTROLS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Slope protection, erosion control, and rip rap placement, and shall consist of all permanent and temporary erosion control features as indicated for the purpose of preventing on-site erosion and maintaining all sediments within the project boundaries and comply with the requirements of the District.

#### **1.02 SCHEDULING**

- A. Apply erosion control features within five days after completion of all other work in each area.
- B. Apply erosion control features as necessary for wet weather conditions and as directed by District.

#### **1.03 REPLACEMENT**

- A. Any area in excess of 100 square feet of dead or damaged erosion control material shall be replaced.
- B. The replaced erosion control shall be of the same formulation and quality as the original.

### **PART 2 PRODUCTS**

#### **2.01 EROSION CONTROL BLANKETS**

- A. Erosion control blankets shall be North American Green single net straw blanket, Western Excelsior excel SR-1, or equivalent.

#### **2.02 FIBER ROLLS**

- A. Fiber rolls shall be netted tubes, at least 12 inches in diameter, filled with straw or equivalent biodegradable product. Installation shall be in accordance with "Erosion and Sediment Control Field Manual" (latest edition) by the California Regional Water Quality Control Board, San Francisco Bay Region.

#### **2.03 STRAW BALES**

- A. Use standard clean straw bales bound with wire.

#### **2.04 SILT FENCE**

- A. Silt fence shall be per "Erosion and Sediment Control Field Manual" (latest edition) by the California Regional Water Quality Control Board, San Francisco Bay Region.

#### **2.05 RIP RAP**

- A. Rip rap shall conform to the weight requirement of Caltrans Section 72 for light rip rap.
- B. Geotextile fabric shall be Mirafi 600X Filter Fabric or equivalent.
- C. Placing
  1. The Contractor shall place a geotextile stabilization fabric over the areas to receive rip rap. Fabric edges shall overlap at least one and one-half feet.
  2. Rip rap shall be placed to the line, grade and depth shown on the plans. Rip rap shall be placed in such a fashion (Caltrans Method A Placement) as not to puncture or tear the underlying fabric. The contractor shall replace torn sections of fabric with a piece of the same fabric. Fabric overlap in these areas shall be at least three feet.
  3. Rip rap shall be placed in such a manner that the material does not segregate itself into areas of larger and smaller rip rap.

#### **2.06 ROCK FILTER**

- A. Rock to be used for the rock filters and for the protection of the construction entrance shall consist of Class 1, Type B Drain Rock conforming to Caltrans Section 68, unless otherwise noted.

#### **2.07 EQUIPMENT, MATERIALS, AND FACILITIES**

- A. Furnish all materials, tools, equipment, facilities, and services as required for providing the necessary erosion controls.
- B. Provide backup equipment as necessary for the replacement and for unanticipated

**END OF SECTION**

## SECTION 32 12 16 – ASPHALTIC CONCRETE PAVING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Specifications for providing asphaltic concrete paving as indicated.

#### 1.02 RELATED SECTIONS

- A. Section 31 20 00 – Earthwork
- B. Section 32 12 22 – Trenching and Backfilling

#### 1.03 REFERENCES

- A. State of California, Department of Transportation (Caltrans), Standard Specifications
  - Section 39 Asphalt Concrete
  - Section 92 Asphalts
  - Section 93 Liquid Asphalts
  - Section 94 Asphaltic Emulsions
- B. State of California, Department of Transportation (Caltrans), Standard Test Methods
  - Calif. Test 202 Method of Tests for Sieve Analysis of Fine and Coarse Aggregates
  - Calif. Test 304 Method of Preparation of Bituminous Mixtures for Testing
  - Calif. Test 366 Method of Test for Stabilometer Value
  - Calif. Test 375 Determining the In Place Density and Relative Compaction of AC Pavement

#### 1.04 PROTECTION

- A. Protect concrete pavements and walks, curbs and bases, and other improvements adjacent to the operations with suitable materials. The Contractor shall be responsible for any damage caused by the Contractor's employees or equipment and shall make necessary repairs. Building and other surfaces shall be covered with paper or other protection, where required. All damage caused by the Contractor's operations shall be prepared or replaced as required.

### PART 2 PRODUCTS

#### 2.01 BASE COURSE MATERIAL

- A. Class 2 Aggregate Base. Percentage composition by weight of aggregate base material shall conform to the 3/4 inch maximum grading when determined by California Test 202.

## **2.02 TACK COAT (VERTICAL SURFACES)**

- A. Tack Coat: Diluted SS-1 or SS-1h emulsion or undiluted RS-1 emulsion in conformance with Section 94 or the Caltrans Standard Specifications.

## **2.03 ASPHALT PAVING MATERIALS**

- A. Paving Asphalt: All purpose, aged residue, steam refined, PG 64-10 grade, in accordance with Section 92 of the Caltrans Standard Specifications.
- B. Aggregate: Type A, with the grading of the combined aggregate conforming to 1/2 inch maximum size, medium grading, as specified in Section 39 of the Caltrans Standard Specifications.
- C. Mixing Facilities: Asphalt concrete surfacing material shall be furnished from an approved commercial asphalt central mixing plant.

## **2.04 SOURCE QUALITY CONTROL**

- A. Contractor shall submit Certificate of Compliance from manufacturer for approval prior to installation.

**END OF SECTION**

## SECTION 32 16 13 Concrete Curbs, Gutters, and Walks

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Specifications for providing portland concrete curbs, gutter, sidewalks, driveways, and island paving, as indicated.

#### 1.02 REFERENCES

- A. American Concrete Institute (ACI):
  - ACI 301 Standard Specifications for Structural Concrete
  - ACI 318/  
381R Building Code Requirements for Structural Concrete and  
Commentary
- B. American Society for Testing and Materials (ASTM)
  - ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc  
Coated, Welded and Seamless
  - ASTM A615/  
A615M Specification for Deformed and Plain Billet-Steel Bars for  
Concrete Reinforcement
  - ASTM A663/  
A663M Specification for Steel Bars, Carbon, Merchant Quality,  
Mechanical Properties
  - ASTM C260 Specification for Air-Entraining Admixtures for Concrete
  - ASTM C309 Specification for Liquid Membrane-Forming Compounds for  
Curing Concrete
  - ASTM C881 Specification for Epoxy-Resin-Base bonding Systems for  
Concrete

#### 1.03 SUBMITTALS

- A. Product Data - Respective manufacturer's product data for manufactured products.

#### 1.04 QUALITY ASSURANCE

- A. Tolerances
  - 1. Construct concrete surfaces within 1/4 inch of the indicated elevation, and deviating not more than 1/8 inch from a 10 foot straightedge placed anywhere on the surface.
  - 2. Slab tolerances shall be as specified in ACI 301.
- B. Finishes

Slab finishes shall be as specified herein accordance with the requirements of ACI 301.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Provide Class of Concrete indicated on the Contract Drawings or Construction Drawings.
  - 1. Provide air-entrainment of three percent ( $\pm$  one percent) with admixture conforming to ASTM C260.
  - 2. Nominal size of large aggregate shall be 1".
  - 3. Minimum total cement content shall be 520 pounds per cubic yard of concrete.
  - 4. Minimum strength of concrete shall be 3000 psi.
- B. Tie Bars - ASTM A615, Grade 60, of type and size indicated.
- C. Dowels - Plain round bars meeting requirements of ASTM A615/A615M, Grade 60, of ASTM A663/A663M, Grade 80, epoxy-coated bars, furnished with approved snugfitting ASTM A53 galvanized pipe sleeve. Provide sleeve with one end closed.
- D. Weep Holes - ASTM A53 galvanized pipe of size indicated.
- E. Concrete Curing Compound - ASTM C309, Type 1.
- F. Epoxy Adhesive - ASTM C881, Type V for load bearing concrete, Grade and Class as determined by project conditions and requirements.

**END OF SECTION**

## SECTION 35 05 16 – UTILITY STRUCTURES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Specifications for the furnishing and installing of cast-in-place concrete and precast concrete structures for utilities as indicated.
- B. The work includes: Catch basins, curb and gutter inlets, manholes, valve boxes, handholes, pull boxes, vaults, covers and the related cast iron, aluminum and steel products required for gratings, covers, and manhole steps and ladders, channel inserts, pulling eyes, and electrical grounding.

#### 1.02 RELATED SECTIONS

- A. Section 31 20 00 - Earthwork
- B. Section 31 23 19 - De-watering

#### 1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
  - ASTM A36/  
A36M                      Specification for Carbon Structural Steel
  - ASTM A48                      Specification for Gray Iron Castings
  - ASTM A108                      Specifications for Steel Bars, Carbon, Cold Finished, Standard Quality
  - ASTM A123                      Specifications for Zinc Coated (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - ASTM A153                      Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware
  - ASTM A536                      Specifications for Ductile Iron Castings
  - ASTM A563                      Specification for Carbon and Alloy Steel Nuts
  - ASTM B3                      Specification for Soft or Annealed Copper Wire
  - ASTM B26/  
B26M                      Specification for Aluminum-Alloy Sand Castings
  - ASTM C33                      Specification for Concrete Aggregates
  - ASTM C150                      Specification for Portland Cement
  - ASTM C260                      Specification for Air Entraining Admixtures for Concrete
  - ASTM C270                      Specification for Mortar for Unit Masonry

- ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections
- ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- ASTM C789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
- ASTM C850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Feet of Cover Subjected to Highway Loadings
- ASTM C858 Specification for Underground Precast Concrete Utility Structures
- ASTM C891 Standard Practice for Installation of Underground Precast Concrete Utility Structures
- ASTM F 436 Specification for Hardened Steel Washers
- B. California Uniform Plumbing Code - Latest Edition
- C. Caltrans Standard Specifications and Drawings - Latest Edition
- D. City of Ukiah Standard Plans and Specifications – Latest Edition

#### **1.04 SUBMITTALS**

A. Shop Drawings

When not indicated on the Contract Drawings in sufficient detail or definition, submit detailed drawings of cast-in-place and precast concrete utility structures and related metal work.

B. Product Data

Submit manufacturer's product data for standard manufactured precast concrete utility boxes and structures and for metal gratings and covers and other related miscellaneous metal items.

C. Certification

Submit certification or other acceptable evidence that covers, grates and structures to be provided for roadways and parking areas meet proof testing requirements for H2O loadings in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

## **PART 2 PRODUCTS**

### **2.01 CAST-IN-PLACE CONCRETE STRUCTURES**

A. Materials

1. Portland Cement

ASTM C150, Type II, low alkali.

2. Admixtures

- a. Air Entrainment: ASTM C260. Provide six percent air entrainment, plus or minus one percent.
- b. Pozzolan: ASTM C618, Class N. Provide pozzolan of 10 percent by weight of the cement content.

3. Aggregates

ASTM C33, fine aggregate and Size No. 67 (3/4 inch maximum size) coarse aggregate.

B. Mix Design - Incorporate the following requirements:

1. Concrete Strength: Class 4000 minimum
2. Maximum water-cement plus pozzolan ratio: 0.45.
3. Maximum slump: Four inches.

## 2.02 PRECAST CONCRETE STRUCTURES

A. General

The Contractor may provide precast concrete structures which conform to the general configuration, capacities, and inverts indicated.

B. Materials

Provide fine and coarse aggregates conforming to ASTM C33, in size commensurate with structure and reinforcement clearances.

C. Portland Cement Concrete

Class 4000 minimum Concrete may be polymer or latex modified to achieve higher strengths and denser concrete. Concrete shall not deteriorate from chemical attack of sanitary waste.

D. Precast Covers

Precast covers shall have the utility identification, such as "PG&E Gas Valve," stamped into the cover.

E. Quality Control

1. Quality Assurance and Control: The Engineer shall perform such inspections and tests as required to verify compliance with these Specifications.
2. Furnish samples of materials and their handling as needed by the Engineer for analyses of materials.

## 2.03 METAL COVERS, GRATES, AND INLETS

A. Ferrous Castings

1. Metal used in manufacture of castings shall conform to ASTM A48, Class 35B for Gray Iron, or ASTM A536, Grade 65-45-12 for Ductile Iron.
2. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Castings shall be smooth and cleaned by shot blasting.
3. Minimum tensile strength shall be 35,000 psi.
4. Castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling. Covers shall be of a type that overlaps box edges.
5. Where castings will be subjected to loads of H20 or greater, as indicated, provide ductile iron castings.

B. Aluminum Castings

Where required to reduce weights of larger covers for ease of handling, such covers may be manufactured of aluminum castings conforming to ASTM B26/B26M, Alloy No. 713.0. Minimum tensile strength shall be 32,000 psi. All covers with an opening four feet or larger shall be Bilco Type JAL-H20 or equivalent and shall have slip resistant surface (course) that meets ADA, NFPA, ASTM D-2047, F-1679 and C-1028. Coatings shall be Traxplate by Jensen or equivalent.

C. Manhole Covers

Provide cast, manufactured manhole covers and frames with heavy duty solid cover (lid) or vented cover (lid) as indicated. Covers shall be embossed or engraved with nonslip diamond or square cross-hatched pattern. Provide covers with embossed or engraved word identification, as indicated or appropriate, for the enclosed or underground utility.

D. Grates

Cast Ferrous Grates: Grates for area drains and catch basins shall be heavy duty, bicycle safe inlet grates and frames of size and configuration indicated. Grates in roadways and parking areas shall withstand H20 loadings when proof-tested in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

E. Curb and Gutter Inlets

Provide cast, manufactured curb inlet frame, grate, and curb box of size and configuration indicated. Curb and gutter inlets shall conform to the contour and profile of the concrete curb and gutter. Grates shall be heavy duty and bicycle safe and shall withstand H20 loading.

F. Cast Iron Manhole Steps

Provide cast, manufactured manhole steps with cross-hatched treads and with anchor configuration appropriate for cast-in-place concrete or precast concrete as indicated. Provide steps for installation 16 inches on center in vertical alignment.

## 2.04 MISCELLANEOUS METAL

### A. Requirements

Provide channel inserts, pulling eyes, ladders, and electrical grounding rods for electrical manholes and pull boxes as indicated.

### B. Steel Materials

Standard structural sections, shapes, plates, bars, and rods, as indicated, conforming with ASTM A36/A36M. Bars conforming with ASTM 108 will be acceptable.

### C. Anchors and Bolts

ASTM A 307, A449, A563, and F436, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.

### D. Ladders

Provide standard manufactured or custom fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication.

### E. Grounding and Bonding Materials

Conform with UL 467 and the following requirements:

1. Grounding Rods: Medium carbon steel core, copper-clad by the molten weld casting process, 3/4 inch diameter by 10 feet long size.
2. Bare Conductors: ASTM B3, No. 1/0 AWG, Class B stranded, annealed copper conductor.

### F. Fabrication

Form and fabricate the work as indicated. Include anchors, fasteners, and accessories to anchor and secure the work in place.

### G. Galvanizing

All items shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123.

## 2.05 MORTAR

- A. Cement mortar for the sealing of openings for pipe penetrations, for cementing of joints of component parts of precast structures, for providing of flow characteristics for the bottoms of drainage structures, and other features as indicated shall conform with the California Building Code, Chapter 21, Type S (without Lime), with a minimum compressive strength at 28 days of 1,800 psi.

- B. Mortar shall comply with applicable requirements of ASTM C270, including measurement, mixing, proportioning and water retention. Ten percent by volume of the cement content of the mortar shall be fly ash or pozzolanic material conforming with ASTM C618.
- C. Use mortar within 90 minutes after mixing. Discard mortar which has been mixed longer or which has begun to set. Retempering of mortar will not be permitted.

**END OF SECTION**

## SECTION 33 11 16 – SITE WATER DISTRIBUTION SYSTEM

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Specifications for providing water service and distribution and modification to existing campus mains and services as indicated. The extent of water distribution is indicated on the Contract Drawings and includes furnishing, installing, testing, and disinfecting permanent water supply piping and services as indicated.
- B. Provide fire hydrants and services as indicated.
- C. The jurisdictional water utility district shall provide water services to the water meters' points of connection for station facilities as indicated on the Contract Drawings. The Contractor shall be responsible for making all such arrangements. All work on the jurisdictional agency's facilities shall be in accordance with the agency's adopted standards and performed by the agency or their representative.

D. Building

#### 1.02 RELATED SECTIONS

- A. Section 31 23 00 - Trenching and Backfilling

#### 1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
  - ASTM A36/  
A36M                      Specifications for Carbon Structural Steel
  - ASTM A126                Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
  - ASTM A123                Specifications for Zinc Coated (Hot Dip Galvanized) Coatings on Iron and Steel Products
  - ASTM A197                Specifications for Cupola Malleable Iron
  - ASTM A307                Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  - ASTM C33                      Specifications for Concrete Aggregates
  - ASTM D1784                Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

ASTM D1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120
ASTM D2564	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping System
ASTM D3139	Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F439	Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

B. American Water Works Association (AWWA)

AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings, three inches through 48 inches (75mm Through 1200mm), for Water and Other Liquids
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C503	Wet-Barrel Fire Hydrants
AWWA C651	Disinfecting Water Mains
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, four inches-12 inches
AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe, 14 inches-48 inches

C. Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

MSS SP-80	Bronze Gate, Globe, Angle and Check Valves
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D. Water Utility District Standards

**1.04 SUBMITTALS**

- A. Shop Drawings, Product Data, and Samples
- B. Manufacturer's product data for manufactured materials and equipment, including all valves and fire hydrants.
- C. Shop drawings showing piping layout and pipe, valves, hydrants, and locations of tie-ins, buttresses, and thrust blocks.
- D. Manufacturer's product data for manufactured materials and equipment, including all valves and fire hydrants.

**1.05 SITE CONDITIONS**

- A. Excavations in which products will be buried shall be dry.

- B. Coordinate the installation of water supply system with the jurisdictional water utility owner.

## **PART 2 PRODUCTS**

### **2.01 BURIED PIPE AND FITTINGS**

#### **A. Requirements**

Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated.

#### **B. PVC Pipe and Fittings, Three Inches and Smaller**

1. Pipe: Polyvinyl chloride (PVC), ASTM D1785, Schedule 80, Type 1, Grade 1.
2. Fittings: ASTM D1784, socket weld, same material and schedule as pipe, or meeting requirements of ASTM F439, as applicable.
3. Joints: Socket welded with PVC solvent cement conforming to ASTM D564.

#### **C. PVC Pipe and Fittings, Four Inches and Larger**

1. Pipe: AWWA C900, SDR 18, Class 235 (AWWA C905, Class 235 for 14" and Larger) polyvinyl chloride (PVC) water pipe with bell and spigot ends and flexible ring joints.
2. Fittings: ASTM D1784, Type 1, Grade 1, polyvinyl chloride (PVC) fittings, Class 305, or meeting requirements or ASTM F439, as applicable.
3. Joints: ASTM D3139, gasketed bell joints with ASTM F477 gaskets.

#### **D. Ductile Iron Pipe (DIP)**

1. Piping: AWWA C151, thickness Class 50.
2. Fittings: AWWA C110.
3. Joints: Field Lok gaskets as manufactured by US Pipe, or equal, with copper jumper to provide electrical continuity. Mechanical, where indicated, in accordance with AWWA C111, with copper jumper to provide electrical continuity.
4. Polyethylene encasement for protection of pipes, valves, and fittings shall be furnished and installed in accordance with AWWA C105.
5. Provide inside pipe and fittings with 1/16 inch thick cement-mortar lining and an asphaltic seal coat in accordance with AWWA C104.

### **2.02 VALVES**

#### **A. Gate Valves**

150 pound bronze, non-rising stem, wedge disc, threaded connection, conforming with MSS SP-80. (AWWA C509 and AWWA C550)

B. Pressure Reducing Valves

All bronze construction, spring-loaded, single-seated, suitable for tight shutoff under dead-end conditions. Provide with renewable composition seat discs, nylon inserted diaphragm, bolted spring chamber, and threaded connection. (AWWA C512)

C. Backflow Preventer

Provide device which is approved by the jurisdictional water utility company. As a minimum, backflow preventer shall be a reduced pressure principle assembly with two rising stem gate shut-off valves, two resilient seat ball-valve test cocks, and two replaceable resilient seat check valves. Backflow preventer shall be suitable for 175 psig operating pressure and 140 degrees F operating temperature and shall be of bronze construction with screwed inlet and outlet for three inch and smaller sizes and cast iron, epoxy coated construction with 150 pound flanged inlet and outlet for four inch and larger sizes. (AWWA C510 and C511)

### 2.03 FIRE HYDRANTS

- A. Provide fire hydrants and related appurtenances as indicated. Fire hydrants shall comply with jurisdictional water utility district, as applicable.
- B. Fire hydrants shall meet requirements of AWWA C503, as applicable, and shall be provided with a minimum of two discharge nozzles and additional pumper connection, meeting the nozzle sizes and pumper requirements of the jurisdictional fire department.
- C. Hydrant bury shall be cast iron with flanged connection at lower end and flanged connection for hydrant. Bury shall meet the requirements of AWWA C 503. All hydrants shall be equipped with a minimum of a 6" riser. Provide new blue reflective marker at location of fire hydrant. Blue reflective marker shall be 4-inch by 4-inch.

### 2.04 CONCRETE FOR THRUST BLOCKS

- A. Provide Class 3000, 3/4 inch aggregate, concrete for all thrust blocks, with reinforcement where indicated or required.

### 2.05 MISCELLANEOUS METAL

A. Tie Rods

Stainless Steel, Type 316, threaded ANSI standard bolt thread both ends, diameter as required.

B. Rod Couplings

Malleable iron, ASTM A197, turnbuckle design, female threaded to mate with tie rods, 5/8 inch sizes to mate with both rods and mechanical joint bolts.

C. Pipe Clamps

For sizes 4 inches and larger, provide with malleable iron rod sockets. Provide washers in lieu of rod sockets where authorized conforming with ASTM A126, Class A, cast iron. Bolts and bolting shall conform with ASTM A307.

D. Exposed Metal

All exposed metal (bends, bolts, glands, rings) shall be wrapped with six inch pipe wrap (tape coat HD 30).

E. Bolt and Nuts

All bolt and nuts shall be Stainless Steel, Type 316, unless noted otherwise.

F. Tracer Wire.

Tracer wire shall be AWG No. 8 insulated copper wire.

G. Couplings.

Flexible coupling assembly shall conform with ASTM A-35, ASTM 633-78, AWWA C219, NSF 61.

**END OF SECTION**

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## SECTION 33 33 00 – SITE SANITARY SEWERAGE SYSTEM

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Specifications for furnishing, installing, testing the site sanitary sewerage system in the ground and to a point outside the building wall as indicated.

#### 1.02 RELATED SECTIONS

- A. Section 31 23 33 - Trenching and Backfilling

#### 1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
  - ASTM D1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
  - ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120
  - ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping System
  - ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
  - ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

#### 1.04 SUBMITTALS

- A. Shop Drawings showing piping layouts, sizes, types, and cleanouts.
- B. Respective manufacturer's product data for manufactured materials and equipment.
- C. Equipment manufacturer's printed operating and maintenance instructions consisting of detailed parts list, recommended spare parts list, and complete operation and maintenance procedures.
- D. Certified test reports of equipment, as applicable.

#### 1.05 SITE CONDITIONS

- A. Excavations shall be dry immediately before and after products are installed. Provide surfaces and structures to, and on, which sewerage products will be installed.

## **PART 2 PRODUCTS**

### **2.01 BURIED PIPE AND FITTINGS**

#### **A. Requirements**

Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated and required.

#### **B. PVC Pipe and Fittings, Three Inches and Smaller**

1. Pipe: Polyvinyl chloride (PVC), ASTM D1785, Schedule 80, Type 1, Grade 1.
2. Fittings: ASTM D1784, socket weld, same material and schedule as pipe.
3. Joints: Socket welded with PVC solvent cement conforming to ASTM D564.

#### **C. PVC Pipe and Fittings, Four Inches and Larger**

Pipe: ASTM D3034 (SDR 26), polyvinyl chloride (PVC) water pipe with bell and spigot ends and flexible ring joints.

#### **D. Couplings.**

Flexible coupling assembly shall conform with ASTM A-35, ASTM 633-78, AWWA C219, NSF 61.

### **2.02 CLEANOUTS**

- #### **A. At grade, cleanouts shall have adjustable sleeve-type housing, threaded brass plug with countersunk slot, and cast iron frame and cover.**

**END OF SECTION**

## SECTION 33 40 00 – SITE DRAINAGE SYSTEM

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Specifications for site area runoff collection system and connection to existing storm drainage system as indicated.

#### 1.02 RELATED SECTIONS

- A. Section 31 23 33 - Trenching and Backfilling
- B. Section 33 05 00 - Utility Structures

#### 1.03 REFERENCES

- A. American Society of State Highway and Transportation Officials (AASHTO)
  - AASHTO M252M Specification for Corrugated Polyethylene Pipe
  - AASHTO M294M Specification for Corrugated Polyethylene Pipe, 300 1200 mm
- B. American Society for Testing and Materials (ASTM)
  - ASTM F667 Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings
  - ASTM F405 Standard Specification for Corrugated Polyethylene Pipe and Fittings
  - ASTM C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
  - ASTM D1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
  - ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120
  - ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping System
- C. Caltrans Standard Specifications - Latest Edition

#### 1.04 SUBMITTALS

- A. Shop Drawings

Detailed drawings that indicate site drainage in plan and section, including relationship to other systems, interfaces, and drainage structures, connections, alignment, grade, bedding and backfill, and other pertinent data.

B. Product Data

Submit manufacturer's product data for pipe and pipe connection materials.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

A. Pipe Connection Requirements

Ends of pipe shall be bell and spigot, except PVC Perp., to assure continuous alignment of pipe and leakproof joints.

B. PVC Pipe (PVC): Pipe shall conform to ASTM D-3034, SDR 26, Bell and Spigot rubber joints for pipe sizes 4" through 8".

C. High Density Polyethylene Pipe (HDPE)

Pipe: HDPE pipe conforming to ASTM D3212, or ASTM 1417 for pipe sizes 8 - 60 inches (ADS N-12 1B WT pipe or equivalent)

**END OF SECTION**