

SPECIFICATIONS  
SFA Project No. 20061

## Boiler Replacement at Harvest Park Middle School

Pleasanton Unified School District  
Alameda County, California



2155 S. Bascom Ave. Suite 200  
Campbell, California 95008  
(408) 879-0600

IDENTIFICATION STAMP  
DIV. OF THE STATE ARCHITECT

APP: 01-119604 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 11/30/2021





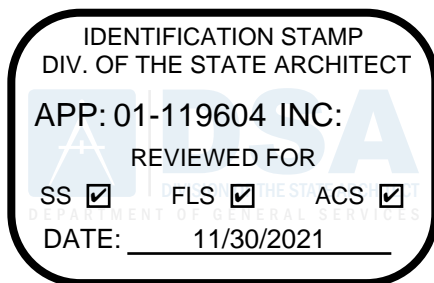
2155 S. Bascom Ave. Suite 200  
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SPECIFICATIONS  
SFA Project No. 20025

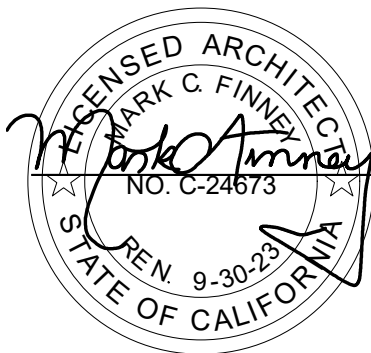
DSA File No. 01-32  
DSA Application No. 01 - 119604

## Boiler Replacement at Harvest Park Middle School

Pleasanton Unified School District  
Santa Clara County, California



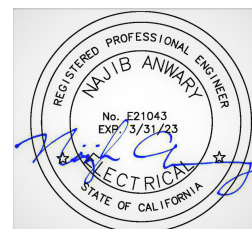
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## **SECTION 02 41 19 – SELECTIVE STRUCTURE DEMOLITION**

### **PART 1 - GENERAL:**

#### **1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Refer to Division 1 for Construction Waste Management and Disposal.

#### **1.02 DESCRIPTION OF WORK:**

- A. Extent of selective demolition work is indicated on drawings.
- B. Types of Selective Demolition Work: Demolition requires the selective removal and subsequent salvage or offsite disposal of the following:
  - 1) Removal of interior partitions as indicated on drawings.
  - 2) Removal of doors and frames indicated "remove".
  - 3) Removal of built-in casework indicated "remove".
  - 4) Removal of existing windows indicated "remove".
  - 5) Removal and protection of existing fixtures and equipment items indicated "salvage".
  - 6) Removal of fixtures, finishes, appliances, etc., indicated "remove".
- C. Removal Work Specified Elsewhere:
  - A. Roofing see Section 07 51 00.
  - B. Cutting non-structural floors and walls for piping, ducts, and conduit is included with the work of the respective mechanical and electrical Divisions 21 through 28 specification sections.
  - C. Cutting holes in roof deck and complete installation of new rooftop equipment is specified in Division 23 sections.
- D. Related Work Specified Elsewhere:
  - 1) Remodeling construction work and patching is included within the respective sections of specifications, including removal of materials for re-use and incorporated into remodeling or new construction.
  - 2) Relocation of pipes, conduits, ducts, other mechanical and electrical work are specified in Divisions 21 through 28.

#### **1.03 SUBMITTALS:**

- A. Schedule: Submit schedule indicating proposed methods and sequence of operations for selective demolition work to Owner's Representative for review prior to commencement of work. Include coordination of shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.

- B. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
- C. Coordinate with Owner's continuing occupation of portions of existing building, with Owner's partial occupancy of completed new addition, and with Owner's reduced usage during summer months.
- D. Coordinate submittal with Division 1 Construction Waste Management and Disposal for construction and demolition waste.

#### 1.04 JOB CONDITIONS:

- A. Occupancy: Owner will be continuously occupying areas of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities which will severely impact Owner's normal operations.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
  - 1) Owner will remove and salvage selected elements from the area of work prior to start of demolition or during progress of work. Elements so affected will be clearly marked/identified and are to be excluded from work.
  - 2) Conditions existing at time of commencement of contract will be maintained by Owner insofar as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
- C. Partial Demolition and Removal: Items indicated to be removed but of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
  - 1) Storage or sale of removed items on site will not be permitted.
- D. Protections: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.
  - 1) Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to and from occupied portions of building.
  - 2) Erect temporary covered passageways as required by authorities having jurisdiction.
  - 3) Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished, and adjacent facilities or work to remain.
  - 4) Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
  - 5) Protect floors with suitable coverings when necessary.
  - 6) Construct temporary insulated solid dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks as required.



- 7) Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.
  - 8) Remove protections at completion of work.
- E. Damages: Promptly repair damages caused to adjacent surfaces by demolition work at no cost to Owner. Restore damaged finishes to match adjacent undamaged work.
- F. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
- G. Explosives: Use of explosives will not be permitted.
- H. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
- 1) Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to governing authorities.
- I. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.
- 1) Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

## PART 2 - PRODUCTS (Not Applicable).

## PART 3 - EXECUTION

### 3.01 INSPECTION:

- A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.
- B. Permits: Where applicable, Contractors shall give all notices to governmental agencies, obtain all required permits, arrange for agency inspections and pay all associated fees related to legally mandated environmental protection regulations.

### 3.02 PREPARATION:

- A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.
- B. Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

- C. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.
- D. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.
- E. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4" studs, 5/8" drywall (joints taped) on occupied side, 1/2" fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation.
- F. Provide weatherproof closures for exterior openings resulting from demolition work.
- G. Locate, identify, stub off and disconnect utility services that are not indicated to remain.
- H. Provide by-pass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shut-down of service is necessary during change-over.

### 3.03 DEMOLITION:

- A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
- B. For renovation work remove existing door hardware indicated to be replaced by new hardware as shown in the door and hardware schedules.
- C. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- D. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors or framing.
- E. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- F. Demolish foundation walls to a depth as indicated but not less than 12" below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
- G. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
- H. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved fill material, gravel or sand, free of trash and debris, stones over 6" diameter, roots or other organic matter. See Division 31 for compaction requirements.
- I. Remove existing door hardware for new door hardware designated on opening and hardware schedules.
- J. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt

of directive from Owner's Representative rearrange selective demolition schedule as necessary to continue overall job progress without delay.

- K. Remove all unused or abandoned (E) electrical, mechanical and plumbing systems in entirety to source. Remove all conduits, conductors, boxes, etc. Patch, repair and paint to match adjacent surfaces.
- L. Remove and dispose of demolished materials per specifications section Division 1- Construction Waste Management and Disposal.

#### 3.04 SALVAGE MATERIALS:

- A. Salvage Items: Where indicated on Drawings as "Salvage Deliver to Owner", carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.
- B. Historic artifacts: including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance remain the property of the Owner. Notify Owner's representative if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.
- C. Carefully remove, clean, and deliver to Owner the following items:

#### 3.05 DISPOSAL OF DEMOLISHED MATERIALS:

- A. Remove debris, rubbish and other materials resulting from demolition operations from building site per Division 1 Construction Waste Management and Disposal.
- B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.
- C. Burning of removed materials is not permitted on project site.

#### 3.06 CLEAN-UP AND REPAIR:

- A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.
- B. Repair all surfaces to match existing surfaces of doors and frames at removed hardware conditions left evident after new hardware installations.
- C. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work. All grass and lawn areas altered or destroyed due to construction work shall be replaced with sod of similar grass type as existing adjacent grasses. Contractor shall ensure lawn is level and returned to its original condition to the satisfaction of the architect.
- D. Repair all surfaces to match existing adjacent surfaces where existing system has been removed and left evident after new system installation, i.e. ducts, louvers, conduits, etc.

#### 3.07 PROJECT CLOSE-OUT: (Not Applicable)

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Harvest Park Middle School  
Pleasanton Unified School District  
SFA Project No. 20061

END OF SECTION 02 41 19

**SECTION 02 81 00 - DISPOSAL OF LAMPS AND BALLASTS**

**PART 1 - GENERAL**

**A. Applicable Regulations:**

1. The applicable sections, latest editions and addenda of the following government regulations, codes, industry standards and recommended practices, form a part of this specification. Nothing in these specifications is to be construed as permitting work not conforming to these regulations.
  - a. Department of Transportation (DOT) Title 49, Code of Federal Regulations (CFR) Part 173 Subpart J.
  - b. Environmental Protection Agency (EPA) Title 40, CFR Part 761.
  - c. Federal Occupational Safety and Health Administration (OSHA) Title 29, CFR 1910 Sections 106, 133, 134, 144.
  - d. State Occupational Safety and Health Administration.
  - e. National Electrical Code (NEC).
  - f. All applicable County and City codes, ordinances and regulations.
2. The contractor is cautioned that he is responsible for ascertaining the extent to which these regulations affect the operations resulting from this solicitation and to comply therewith.

**B. Project Description:**

1. The Contractor shall provide all labor, materials, equipment, transportation, documentation and services necessary for the destruction of all PCB ballast's and lamps potentially containing mercury removed from the existing lighting fixtures associated with the project.
2. The BASE BID shall include the cost of disposal of the PCB ballast's and lamps as described in this specification.
3. All disposals shall conform to 40 CFR Part 761.
4. An EPA approved incinerator shall dispose of all PCB-containing material, solid or liquid. Separate the PCB-containing portions of the ballasts from the non-PCB portions. The non-PCB portions shall be processed to reclaim recyclable components such as copper and steel.
5. Ballast's carcasses and lamps potentially containing mercury shall be totally destroyed by an EPA approved facility.
6. Landfill of any PCB or mercury waste is prohibited.

**C. Contractor Qualifications:**

1. Each bidder shall provide written evidence that, as a major part of this business, the bidder has been engaged in PCB and mercury disposal activities including

processing and destruction of PCB ballast's and lamps containing mercury. Related activities shall include transportation, EPA required documentation, servicing and storage of high and low concentrations of PCB fluids and solids, and destruction of PCB carcasses and disposal of lamps potentially containing mercury.

2. Bidder's service personnel shall be, at a minimum, qualified individuals who have completed a formal training program in the handling, processing and safety precautions associated with PCB fluids and mercury.
3. Each bidder shall submit a reference list of twenty or more customers they have successfully contracted with for PCB and mercury services. The customers' name, address, telephone number and key contact person with the company shall be approved with the bid.
4. The bidder's PCB and mercury destruction facility must have a full commercial operating permit from EPA and shall submit a copy of this permit with the bid.

E. Containerization and Marking:

1. All PCB ballast's and hazardous materials, including lamps potentially containing mercury, generated from project activities and clean up operations shall be placed in EPA specified containers. Only approved drums, tippler cans or wood crates conforming to EPA specifications shall be used to containerize non-leaking ballasts and lamps.
2. All containers used shall be properly sealed, marked, labeled and dated.

F. Transportation to Destruction/Service Facilities:

1. All ballast's and lamps potentially containing mercury shall be transported to an EPA-approved processing/destruction facility.
2. All PCB-containing capacitors and components shall be transported to an EPA-approved incinerator.
3. For the disposal of leaking PCB ballast's and associated waste, the contractor and/or subcontractor and vehicles must be licensed for the transportation and hauling of extremely hazardous wastes. The drivers of these vehicles shall be trained in the laws, rules and regulations governing the transportation of PCB materials. The vehicles must be plainly marked as specified by the U.S. Department of Transportation, EPA, State Department of Health Services, State Highway Patrol and State Department of Transportation.

G. Insurance:

1. The Contractor shall possess the following minimum insurance and provide certificates from qualified insurers attesting same.
  - a. Pollution Liability Insurance - \$5,000,000 per occurrence, \$5,000,000 aggregate and covering all necessary or reasonable costs or expenses of removing, nullifying, cleaning up, or rendering ineffective any accidental spillage.

- b. Comprehensive General Liability - \$5,000,000 combined single limit per occurrence.
  - c. Comprehensive Automobile Liability - \$5,000,000 combined single limit per occurrence.
2. Evidence of reliable insurance coverage and assets to fully indemnify against long-term liabilities and/or catastrophic occurrences shall be a part of the evaluation criteria for award of the contract.

H. Documentation:

- 1. The Contractor shall provide the Owner with comprehensive information on all firms to be involved in PCB related work activities as part of this contract prior to commencement of the project. Such information shall include a minimum of:
  - a. Name, address, telephone number, and EPA ID number, State Transporters ID number and Hauler Registration number of the firm(s) responsible for the transportation of PCB solids and fluids, ballast and/or lamp potentially containing mercury sealed containers.
  - b. Name, address, telephone number and EPA ID number of the firm(s) responsible for the ultimate disposal/destruction of all PCB articles and any other hazardous waste, including lamps potentially containing mercury generated in the course of the work.
  - c. Name, address, telephone number and EPA ID number of the firm(s) responsible for the ultimate final destruction of the ballasts and reclamation of recyclable components.
- 2. The Contractor shall provide the Owner with comprehensive documentation of all work activities upon completion of the work and prior to final payment. Such documentation shall include a minimum of:
  - a. Type and size of containers, contents, weight or unit of measure, date transported and name, address, telephone number and EPA ID number of processing and/or disposal facility.
  - b. Written certification; i.e., Uniform Hazardous Waste Manifest demonstrating receipt of material at the disposal/incineration facility. Such certification shall be signed by the person authorized by the disposal/incineration facility to accept PCB items for disposal.
  - c. Certificate of Destruction for PCB liquids, solids and ballast carcasses and lamps potentially containing mercury.

*(Project Closeout)*

END OF SECTION

## **SECTION 06 10 00 - ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Framing with dimension lumber.
  - 2. Rooftop equipment bases and support curbs.
  - 3. Wood blocking, cants, and nailers.
  - 4. Wood furring and grounds.

#### **1.2 DEFINITIONS**

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
- B. Exposed Framing: Dimension lumber not concealed by other construction.
- C. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section where cited by abbreviations noted below (latest editions apply):
  - 1. APA – American Plywood Association
  - 2. AF & PA – American Forest and Paper Association
  - 3. ASTM – American Society of Testing and Materials
  - 4. AWWA – American Wood Preservers Association
  - 5. CBC – California Building Code (Title 24 2001 Edition)
  - 6. PS – United States Product Standard
  - 7. RIS - Redwood Inspection Service.
  - 8. UL – Underwriters Laboratories, Inc.
  - 9. WCLIB - West Coast Lumber Inspection Bureau.
  - 10. WWPA - Western Wood Products Association.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.



3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
  2. Fire-retardant-treated wood.
  3. Power-driven fasteners.
  4. Powder-actuated fasteners.
  5. Expansion anchors.
  6. Metal framing anchors.
- C. Submit full range of nails and fasteners for verification of compliance.

#### 1.4 QUALITY ASSURANCE

- A. Comply with Title 24, Part 2, Chapter 23, 2019 C.B.C.
- B. Lumber Standards: Furnish lumber manufactured to comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.
- C. Plywood Product Standards: Comply with PS 1, or PS 1-95, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel indicated.
- D. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under temporary coverings including polyethylene and similar materials. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Protect against damage to edges, ends and surfaces.

#### 1.6 JOB CONDITIONS

- A. Coordination: Fit carpentry work to other work and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.
- B. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19 percent before, during and after installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Expansion Bolts:
    - a. Ramset/Redhead "TruBolt
    - b. Hilti-KB-Tz2
  2. Powder Driven Fasteners:
    - a. Hilti Fastening Systems
    - b. Impex Tool Corporation

### 2.2 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 "American Softwood Lumber Standard" and with applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
  3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  4. Provide dressed lumber, S4S, unless otherwise indicated.
  5. Provide dry lumber with 19 percent maximum moisture content at time of installation. In the event any wood members twist, warp or split as they dry, and no longer meet the requirements of the grading rules for the grade stamp on the piece, the out-of-grade members shall be removed and replaced.

### 2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2 (lumber) and AWPAC9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
    - a. Ammoniacal copper zinc arsenate (ACZA). (Sill Plates on concrete only.)
  2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 2. Wood framing members less than 18 inches above grade.

## 2.4 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
  - 1. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.
- B. Structural Light Framing: 2 inches to 4 inches thick, 2 inches to 6 inches wide.
  - 1. No. 1 grade Douglas Fir, per WCLIB rules, paragraph 124 (b).
- C. Structural Framing: 2 inches to 4 inches thick, 5 inches or wider.
  - 1. No. 1 grade or better Douglas Fir, per WCLIB rules, paragraph 123 (b).
- D. Sill Plates: Pressure treated Douglas Fir, No. 2 minimum.
- E. Posts and Timber: 5 inches and thicker.
  - 1. Select Structural Douglas Fir, per WCLIB rules, paragraph 131 (a)
  - 2. Free of heart center.
- F. Beams and Stringers: 5 inches and thicker, with more than 2 inches greater than thickness.
  - 1. Select Structural Douglas Fir, per WCLIB rules, paragraph 130 (a).

## 2.5 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as required.
  - 1. Grade of lumber to be as for Structural Light Framing.

## 2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667, FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers. No upset threads allowed.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  1. Material (interior): Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  2. Material (exterior): Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.7 MISCELLANEOUS MATERIALS

- A. Building Paper: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.
- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.
- C. Water-Repellent Preservative at Exposed Ends of Posts and Beams: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Framing shall comply with Chapter 23, 2013 C.B.C.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

- C. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Install framing members of size and spacing indicated. Anchor and nail as shown. Comply with Table No.23A-II-I-1, 23A-II-H – “Recommended Nailing Schedule” of C.C.R. Title 24, Part 2, Chapter 23. Do not splice structural members between supports.
- F. Fire blocks and draft stops shall be provided as required by Chapter 7, 2013 C.B.C.
- G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- H. Refer to drawings for other types of fasteners.

### 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
  - 1. Fire block furred spaces of walls, at each floor level and at ceiling, with wood blocking or noncombustible materials accurately fitted to close furred spaces.
- B. Suspended Furring: Provide size and spacing shown, including hangers and attachment devices. Level to a tolerance of 1/8 inch in ten feet.

### 3.4 WOOD FRAMING INSTALLATION, GENERAL

- A. The following paragraphs are applicable unless conditions are detailed otherwise on the structural drawings.
- B. Framing shall comply with Chapter 23, 2019 C.B.C.
- C. All nailing shall confirm to CBC Table 2304.10.1 , except where more stringent requirements are shown on drawings.
- D. Do not splice structural members between supports.
- E. Fire blocks and draft stops shall be provided as required by Chapter 7, 2013 C.B.C.

### 3.5 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Arrange studs so wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs. Anchor or nail plates to supporting construction, unless otherwise indicated.
  - 1. For walls, provide 2-by-6-inch nominal size wood studs, unless otherwise shown, spaced at 16 inches o.c., unless otherwise indicated.
- B. Construct corners and intersections with three or more studs. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide continuous horizontal blocking at midheight of partitions more than 120 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- C. Fire block concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where fire blocking is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- thick lumber of same width as framing members.
- D. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.
- E. Provide shear plywood where shown in walls, at locations indicated

### 3.6 MACHINE APPLIED NAILING

- A. The following machine applied nailing is accepted subject to the following applications, locations of use, conditions and continued satisfactory performance. All nail shank, head diameter and length shall be the same dimensions as for a common nail of it's comparable size. Short nails may be used if the minimum penetration is maintained.
  - 1. Minimum Penetration into Studs:
    - a. 8D Common - 1-1/2 inch
    - b. 10d Common - 1-5/8 inch

- c. 16d Common - 1-3/4 inch
- 2. Conditions:
  - a. A satisfactory jobsite demonstration is required for approval by the Project Architect or Structural Engineer and the DSA Field Engineer. The approval is subject to continued satisfactory performance. If nail heads penetrate the outer surface more than would be normal for a hand hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory.
  - b. Nails shall be full headed common wire nails with spacing as shown on the Structural Drawings.
  - c. Minimum edge distance of nail from the edge of plywood and framing shall be 3/8 inch for 2x framing. For 3x and thicker framing, distances shall be measured at the surface between the plywood and backing. The plywood joint shall be centered over a single member.
  - d. Only 1/2 inch or greater thickness of plywood, may be machine nailed.
  - e. Slanting of nails to direct the nail toward the center line of the framing may be done but slope should not be more than 1 in 6 from a line at right angles to the surface of the plywood.
  - f. Overdriving of nails such that the heads cut the outer veneer is not allowed. Re-nailing may not be accepted as a remedy.
  - g. Underdriven nails are required to be driven with a hand held hammer so that the head of the nail is flush with the top surface of the plywood.
  - h. Machine nailing shall be used only where the back side can be inspected for "shiners".
  - i. "Shiners" or nails which do not penetrate fully into framing or blocking shall be removed and replaced. All remedial nailing shall be done by hand.
  - j. If any framing members, blocking or joists, receiving the points of the nails, are damaged (split, nail holes too close, etc.), they shall be removed and replaced.
  - k. Toe and end gun nailing are not permitted.

### 3.7 ATTIC ACCESS

- A. Opening 22 inches by 30 inches is required with 30 inch and greater clear headroom. If 30 inch or less clear height then access opening not required.

### 3.8 VENTILATION:

- A. 1 square foot per 150 square feet of attic area or rafter area above insulation if no eave vents are provided and insulation is not graphically shown attached to the roof sheathing sides. And 1 square foot per 300 square feet if at least 50 percent of required area is provided at eave line.

### 3.9 WINDOW AND DOOR FLASHING

- A. Apply flashing material horizontally with 2 inch over-lap and 6 inch end lap; fasten to sheathing with corrosion resistant staples.

3.10 BUILDING PAPER APPLICATION

- A. Apply building paper horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with corrosion resistant staples or roofing nails. Cover upstanding flashing with 4-inch overlap.

3.11 DEBRIS REMOVAL

- A. Remove all wood, including form lumber, chips, shavings and sawdust in or on ground and from any area under floor if applicable. No wood shall be buried in any fill.

END OF SECTION 06 10 00



**SECTION 06 20 00 - FINISH CARPENTRY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Exterior standing and running trim.
2. Exterior lumber and plywood siding.
3. Exterior plywood soffits.
4. Interior standing and running trim.
5. Interior plywood and board paneling.

- B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Division 6 Section "Exterior Architectural Woodwork" for exterior woodwork not specified in this Section.
3. Division 6 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.
4. Division 8 Section "Door Hardware" for Builders Hardware.
5. Division 8 Section "Wood Doors".
6. Division 9 Section "Painting" for priming and back-priming of finish carpentry.

1.3 DEFINITIONS

- A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWI – American Woodwork Institute
4. NHLA - National Hardwood Lumber Association.
5. RIS - Redwood Inspection Service.
6. WCLIB - West Coast Lumber Inspection Bureau.
7. WI - Woodwork Institute "Manual of Millwork".
8. WWPA - Western Wood Products Association.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
  - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Samples for Verification:
  - 1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
  - 2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.
- C. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer.
- B. Fire-Test-Response Characteristics: Where fire-retardant materials are indicated, provide materials with specified fire-test-response characteristics as determined by Underwriters Laboratory, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency on surfaces of materials that will be concealed from view after installation.
- C. Treated Wood Materials: Submit chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials. For each type specified, include certification by treating plant stating chemical solutions used, submersion period and conformance with specified standards.
- D. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.
- E. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in the meeting the Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms

and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
- B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Plywood Siding:
    - a. Champion International Corp.
    - b. Georgia-Pacific Corp.
    - c. Louisiana-Pacific Corporation.
    - d. Pacific Wood Laminates, Inc.
    - e. Simpson Timber Co.
  - 2. Hardwood Veneer Plywood Paneling:
    - a. Champion International Corp.
    - b. Georgia-Pacific Corp.
    - c. Weyerhaeuser Company.

## 2.2 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.
  - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
  - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- B. Softwood Plywood: DOC PS 1/ANSI A199.1.
- C. Hardwood Plywood: HPVA HP-1.
- D. Hardboard: AHA A135.4
- E. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
- F. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

## 2.3 WOOD-PRESERVATIVE-TREATED MATERIALS (Trt-Wd)

- A. Water-Repellent Preservative Treatment by Non-pressure Process: AWP A N1.
  - 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with an insecticide containing chlorpyrifos.
  - 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
  - 3. Application: Exterior trim and wood siding.

## 2.4 FIRE-RETARDANT-TREATED MATERIALS (F Trt-Wd)

- A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:
  - 1. Flame-spread index of not greater than 25 when tested according to ASTM E 84.
- B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- C. Exterior-Type Fire-Retardant Treatment: Organic-resin-based formulation that shows no increase in flame spread of treated material after being weathered according to ASTM D 2898, Method A.
- D. Interior, Low-Hygroscopic-Type, Fire-Retardant Treatment: Formulation that results in treated material with an apparent moisture content of not more than 28 percent when tested according to ASTM D 3201 at 92 percent relative humidity.

- E. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber and plywood from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- F. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

## 2.5 EXTERIOR STANDING AND RUNNING TRIM

- A. Lumber Trim for Semitransparent-Stained or Clear-Finished Applications: Kiln-dried lumber with saw-textured face and of the following species and grade:
  - 1. Clear All Heart redwood where indicated; RIS.
  - 2. Grade B & B Btr. - 1 & 2 Western red cedar where indicated; WCLIB, or WWPA.
- B. Lumber Trim for Painted Applications: Kiln-dried, finger-jointed or solid lumber with surfaced smooth face and of the following species and grade:
  - 1. Clear redwood; RIS.
  - 2. Grade B & B Btr. - 1 & 2 Western red cedar; WCLIB, or WWPA.
- C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.
  - 1. Moldings for Semitransparent Finish (Stained Finish): N-grade redwood, western red cedar, or sugar pine as indicated.
  - 2. Moldings for Opaque Finish (Painted): P-grade redwood, western red cedar, or sugar pine.
  - 3. Patterns as indicated.
- D. MDO Trim: Exterior Grade B-B, MDO plywood.

## 2.6 SIDING

- A. Plywood Siding for Painted Finish: MDO/EXT-APA-Rated siding.
  - 1. Thickness: As indicated.
  - 2. Pattern: As indicated.
- B. Siding Colors, Textures, and Patterns: Where manufacturer's standard products are indicated, provide siding with the following requirements:
  - 1. As selected by Architect from manufacturer's full range.

## 2.7 INTERIOR STANDING AND RUNNING TRIM

- A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish): Kiln-dried finished lumber (S4S) of the following species and grades:

1. Grade - Clear All Heart Redwood where indicated; Para 103 RIS.
  2. Clear Heart western red cedar where indicated; WCLIB, or WWPA.
  3. Manufactured to sizes and patterns (profiles) shown.
- B. Lumber Trim for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:
1. Grade D Select (Quality) Idaho white, lodgepole, ponderosa, or sugar pine; WWPA.
  2. Grade D Select white woods; WWPA.
  3. Grade A Finish alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA.
- C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.
1. Moldings for Transparent Finish (Stain or Clear Finish): N-grade Idaho white, lodgepole, ponderosa, or sugar pine, western red cedar, douglas fir, or yellow poplar].
    - a. Provide material selected for compatible grain and color.
  2. Moldings for Opaque Finish (Painted): P-grade Idaho white, lodgepole, ponderosa, or sugar pine, or yellow poplar.
  3. Manufactured to sizes and patterns (profiles) shown.

## 2.8 PANELING

- A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with applicable requirements in HPVA HP-1.
1. Face Veneer Species: Plain-sliced red oak.
  2. Backing Veneer Species: Any hardwood compatible with face species.
  3. Construction: Veneer core.
  4. Thickness: 7/16 inch.
  5. Panel Size: As indicated on the drawings.
  6. Glue Bond: Type II (interior).
  7. Face Pattern: As selected by Architect from manufacturer's standard patterns.
  8. Finish: As selected by Architect from manufacturer's full range.

## 2.9 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer:
1. Hot-dip galvanized steel.
  2. Pre-finished aluminum in color to match stain, where face fastening of material to receive stain is unavoidable.
- B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
  - C. Paneling Adhesives: Comply with paneling manufacturer's written recommendations for adhesives.
  - D. Flashing: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim" for flashing materials installed in finish carpentry.
    1. Horizontal Joint Flashing for Siding: Preformed galvanized steel Z-shaped flashing.
  - E. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.
- 2.10 FABRICATION
- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.
  - B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
    1. Exterior standing and running trim wider than 5 inches.
    2. Interior standing and running trim, except shoe and crown molds.
    3. Wood board paneling.
  - C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

#### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

- B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.
- C. Painted Lumber: Prime lumber for exterior applications to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 9 Section "Painting."

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
  - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
  - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

### 3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
  - 1. Match color and grain pattern across joints.
  - 2. Install trim after gypsum board joint finishing operations are completed.
  - 3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
  - 4. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

### 3.5 SIDING INSTALLATION

- A. Plywood Siding: Install panels with edges over framing or blocking. Nail at 6 inches o.c. at panel perimeter and 12 inches o.c. at intermediate supports, unless manufacturer recommends closer spacing. Leave 1/16-inch gap between adjacent panels and 1/8-inch gap at perimeter and openings, unless otherwise recommended by panel manufacturer.



1. Seal butt joints at inside and outside corners and at trim locations.
  2. Install continuous metal flashing at horizontal panel joints with 1/8-inch expansion gap.
  3. Apply battens and corner trim as indicated.
  4. Conceal fasteners to greatest practical extent by countersinking and filling, by placing in grooves of siding pattern, or by concealing with applied trim or battens as detailed. Do not nail through overlapping pieces.
- B. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.
- C. Finish: Apply finish within two weeks of installation.
- D. Install siding to comply with manufacturer's warranty requirements.

### 3.6 PANELING INSTALLATION

- A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
  2. Conceal fasteners to greatest practical extent.
  3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

### 3.7 ADJUSTING

- A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### 3.8 CLEANING

- A. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

### 3.9 PROTECTION

- A. Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that the work will be without damage or deterioration at time of acceptance.

END OF SECTION 06 20 00

(3/06)

## **SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Work under this section comprises of furnishing hollow metal doors and frames, including transom frames, sidelight and window frames with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled.
  - 1. Flush Steel Doors.
  - 2. Temperature Rise Doors.
  - 3. Embossed Panel Doors.
  - 4. Full Glass Entrance Doors.
  - 5. Hurricane Doors.
  - 6. Steel frames.
  - 7. Hollow Metal Framing Systems.
- B. Related Sections: Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section. The latest published edition of each reference applies.
  - 1. Division 6 – Rough Carpentry
  - 2. Division 8 – Stainless Steel Doors and Frames
  - 3. Division 8 – Wood Doors
  - 4. Division 8 – Plastic Doors
  - 5. Division 8 – Special Function Doors
  - 6. Division 8 – Door Hardware
  - 7. Division 8 – Glazing
  - 8. Division 9 – Painting and Coating
  - 9. Division 13 – Radiation Protection
  - 10. Division 26 – Low Voltage Electrical Power Conductors and Cables
  - 11. Division 28 – Access Control
- C. References: The intent of this document is that all hollow metal and its application will comply or exceed the standards identified below. The latest published edition of each reference applies.
  - 1. ANSI - American National Standards Institute - [ansi.org](http://ansi.org)
  - 2. NFPA - National Fire Protection Association
    - a. NFPA 80 - Standard for Fire Doors and Other Opening Protectives
    - b. NFPA 101 – Life Safety Code
    - c. NFPA 105 – Standard Smoke Door Assemblies and Other Opening Protectives
    - d. NFPA 252 - Standard Method of Fire Tests of Door Assemblies.
  - 3. DHI - Door and Hardware Institute – Door Security + Safety Professionals
    - a. Installation Guide for Doors and Hardware.
    - b. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
    - c. Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.
  - 4. SDI - Steel Door Institute
    - a. SDI-105 – Recommended Erection Instructions for Steel Frames
    - b. SDI-107 – Hardware on Steel Doors (Reinforcement - Application)
    - c. SDI-111 - Recommended Details for Standard Steel Doors, Frames, Accessories,

- and Related Components
  - d. SDI-117 - Manufacturing Tolerances Standard Steel Doors and Frames
  - e. SDI-118 – Basic Fire Door Requirements
  - f. SDI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
  - g. SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors
  - h. SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
  - i. SDI A250.8 - SDI-100 Specifications for Standard Steel Doors and Frames
  - j. SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
  - k. SDI A250.11 - Recommended Erection Instructions for Steel Frames
  - l. SDI A250.13 Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies
5. BHMA - Builders Hardware Manufacturers Association
- a. BHMA A156.115 - Hardware Preparations in Standard Steel Doors and Frames.
  - b. BHMA A156.7 - Hinge Template Dimensions.
6. ASTM - American Society for Testing Materials
- a. ASTM A568/A568M-19a Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements
  - b. ASTM A879/A879M-12(2017) Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
  - c. ASTM A653/A653M-19a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - d. ASTM A924/A924M-19 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - e. ASTM A1008/A1008M-18 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
7. ICC - International Code Counsel
- a. ICC A117.1 – Accessible and Usable Building and Facilities.
  - b. ICC 500 Standard for the Design and Construction of Storm Shelters
8. UL - Building Materials Directory; Underwriters Laboratories Inc.
- a. UL 10B - Standard for Neutral Pressure Fire Tests of Door Assemblies
  - b. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies
  - c. UL 1784 – Air Leakage Test of Door Assemblies
  - d. UL 752 – Standard for Bullet-Resisting Equipment
9. NAAMM/HMMA – National Association of Architectural Metal Manufacturers/Hollow Metal Manufacturers Association
- a. NAAMM/HMMA 840 – Guide Specification for Receipt, Storage, and Installation of Hollow Metal Doors and Frames.
10. WH - Certification Listings; Warnock Hersey International Inc.
11. Federal Emergency Management Agency (FEMA) 361 Guidelines, ICC500 - 2014
12. Miami - Dade County test protocols PA 201, PA 202 and PA 203.
13. Florida Building Code test protocols TAS 201, TAS 202 and TAS 203.

14. Texas Department of Insurance TDI - Complies with TAS 201, TAS 202 and TAS 203, Large Missile Impact.

1.2 SUBSTITUTIONS:

- A. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and their consultant

1.3 SUBMITTALS

- A. Submittals to comply with provisions of Division 01, Submittal Procedures.
- B. Product Data: Manufacturer's standard details and catalog data indicating compliance with referenced standards and manufacturer's installation instructions.
- C. Shop Drawings: Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents. Shop drawings should include the following information to ensure doors and frames are properly prepared and coordinated to receive hardware.
1. Elevations of each door and frame type.
  2. Details for door core.
  3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  4. Locations of cutouts for glass and louvers.
  5. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  6. Mounting locations for hardware.
  7. Thickness of reinforcement/preparations for hardware.
  8. Details of anchorages, joints, field splices, and connections.
  9. Details of accessories.
  10. Details of moldings, removable stops, and glazing.
  11. Fire ratings.
  12. Finish.
- D. LEED Submittals: If required, provide documentation of how the requirements will be met:
1. Program Based on the U.S. Green Building Council LEED Reference Guide for Green Building Design and Construction Publication for the design, construction and major renovations of commercial and institutional buildings including core and shell and K-12 school projects.
  2. Credits MR 4.1 and MR 4.2: Use materials with recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20% total based on cost of the total values of the material in the project.
    - a. Credits:
      - 1) MR 4.1: 1 point -recycled content is at least 10% of the total value of the materials in the entire project.
      - 2) MR 4.2: 1 additional point added to the MR 4.1 point – recycle content is at least 10% (MR 4.1 percentage plus an additional amount to equal a minimum of 20%) of the total value of the materials in the entire project.
  3. Credits 5.1 and 5.2: Used building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.
    - a. Credits:
      - 1) MR 5.1: 1 point – At least 10% of the materials are extracted, processed and manufactured regionally.
      - 2) MR 5.2: 1 additional point added to the MR 5.1 point – At least 20% (MR 5.1

percentage plus an additional amount to equal a minimum of 20%) of materials are extracted, processed and manufactured regionally.

- E. Samples: 12 by 12 inches (304 mm by 304 mm) cut away sample door with provisions for lockset, hinge and corner section of frame welded and prepped for specified hardware. Sample should be furnished with submittals for Owner approval. After approval return sample to door/frame supplier as confirmation of approved construction.
- F. Closeout Submittals to comply with Division 1, Closeout Submittals procedures.
- G. Furnish copies of manufacturer's warranty information and maintenance instructions.

#### 1.4 QUALITY ASSURANCE

- A. Hollow Metal Distributor is to be a direct account of the manufacturer of the products furnished. In addition, that distributor must have in their regular employment an Architectural Hardware Consultant (AHC), Certified Door Consultant (CDC), an Architectural Openings Consultant (AOC), a Door & Hardware Consultant (DHC) or equivalent door and hardware industry experience who will be available to consult with the Architect and Contractor regarding any matters affecting the door and frame opening.
- B. Manufacturer Qualifications: Certified Member of the Steel Door Institute in good standing.
- C. Installer: Minimum five years documented experience installing products specified this Section.
- D. Certificates:
  - 1. Manufacturer's certification that products comply with referenced standards.
  - 2. Hollow Metal Manufacturer must provide documentation that they are an SDI Certified Manufacturer.
- E. Fire Rated Doors and Frames: Underwriters' Laboratories, Intertek Testing Services/Warnock Hersey, and Factory Mutual labeled fire doors and frames:
  - 1. Provide labeled fire doors and frames in accordance with Underwriters Laboratories standard UL10C Positive Pressure Fire Tests of Door Assemblies.
  - 2. Construct and install doors and frames to comply with current issue of NFPA 80.
  - 3. Manufacture Underwriters' Laboratories labeled doors and frames in strict compliance to UL procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.
  - 4. Manufacture Intertek Testing Services /Warnock Hersey labeled doors and frames in strict compliance to ITS/WH procedures and provide the degree of fire protection capability indicated by the opening class.
  - 5. Manufacture Factory Mutual labeled doors and frames in strict compliance to FM procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.
  - 6. Affix a physical label or approved marking to each fire door and/or fire door frame, at an authorized facility as evidence of compliance with procedures of the labeling agency.
  - 7. Conform to applicable codes for fire ratings. It is the intent of this specification that doors, frames, hardware and their application comply or exceed the standards for labeled openings. In case of conflict between types required for fire protection, furnish type required by NFPA and UL.
  - 8. Provide Temperature Rise Fire Door Assemblies in exit enclosures and exit passageway with maximum transmitted temperature end point rating of not more than 250 degrees F (121 degrees C) above ambient at the end of 30 minutes of the standard fire test exposure.
  - 9. For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided to prevent rust or damage.
2. Provide cardboard wrapped or crated product to provide protection during transit and job site storage
3. Should wrappers become wet, remove immediately

B. Delivery and Site Acceptance

1. The supplier shall deliver all materials to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Supplier shall coordinate delivery times and schedules with the contractor.
2. Deliver doors cardboard wrapped or crated to provide protection during transit and job site storage. Provide additional protection to prevent damage to any factory-finished doors. Mark all doors and frames with architects opening numbers as shown on the contract documents and shop drawings on the center hinge preparation location.
3. Upon delivery, check in doors and frames jointly with supplier. Inspect doors and frames upon delivery for damage, correct quantities or shortages. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect. Otherwise, remove and replace damaged goods as directed. Note shortages and replace immediately.

C. Storage and Protection

1. Handle, store and protect products in accordance with the manufacturers printed instructions, ANSI/SDI A250.8 – Specifications for Standard Steel Doors and Frames, A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames, or ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames and NAAMM/HMMA 840 – Guide Specification for Receipt, Storage, and Installation of Hollow Metal Doors and Frames.
2. Store all materials in a dry area. All hollow metal material shall be stored so that it does not come in contact with water or moisture. Protect units from adverse weather elements.
3. Place units on 4 inch (102 mm) high wood sills to prevent rust and damage.
4. Store doors vertically under a properly vented cover, five units maximum in a stack with a ¼" space between doors to permit air circulation.
5. Store frames in an upright position with heads uppermost under cover.
6. Store assembled frames five units maximum in a stack with 2-inch (51 mm) space between frames to permit air circulation.

1.6 COORDINATION

- A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.
- B. Coordinate Work with frame opening construction, door and hardware installation.
- C. Sequence installation to accommodate required door hardware.
- D. Verify field dimensions for factory assembled frames prior to fabrication.

1.7 WARRANTY

- A. Comply with Division 01 Closeout Submittals
- B. All doors and frames shall be warranted in writing by the manufacturer against defects in materials and workmanship for a period of one (1) year commencing on the date of manufacture.

**PART 2 PRODUCTS**

## 2.1 MANUFACTURERS

- A. Basis of Design - MESKER a dormakaba Brand, Web: <http://meskerdoor.com>
  - 1. Acceptable Manufacturer - Curries an ASSA Abloy Company
  - 2. Acceptable Manufacturer - Steelcraft an Allegion Company
- B. Provide all steel doors and frames from a single SDI certified manufacturer.

## 2.2 General:

- A. Physical performance: Units shall comply with the 1 million cycles swing test requirement per ANSI A250.4 - Level A.
- B. Finishing:
  - 1. Prime Gray to meet SDI A250.10
- C. Electrical Requirements: Coordinate all electrical requirements for doors and frames. Make provisions for installation of electrical items so that wiring can be readily removed and replaced.
  - 1. Provide cutouts and reinforcements required for metal doors and frames to accept electric components.
  - 2. Frame with Electrical Hinges: Junction box welded over center hinge reinforcing. Top or bottom hinge locations are not permitted.
  - 3. Coordinate with Section 08 71 00 (or Division 28) for electrified hardware items.

## 2.3 DOORS

- A. General: Construct exterior/interior doors to the following designs and gauges:
  - 1. Exterior and Non-Corrosive Doors: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A653/A653M:
    - a. Thickness:
      - 1) 16 gauge
    - b. Provide flush top/closed top channel for exterior swing-out doors to eliminate moisture penetration. Galvanized steel top caps are permitted.
  - 2. Interior Doors: Cold-rolled steel, ASTM A 1008/A 1008M:
    - a. Thickness:
      - 1) 18 gauge
  - 3. Interior Doors: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A653/A653M at all areas where moisture is a concern:
    - a. Thickness:
      - 1) 18 gauge
  - 4. Door Thickness: 1-3/4 inches
  - 5. Vertical edge seams: Provide doors with continuous vertical mechanical inter-locking joints at lock and hinge edges. Finish edges as follows:
    - a. Filled Vertical Edges (S): Continuous vertical mechanical interlocking joints with tack welds every 8 inches. Putty or filler applied to the edge seam and ground smooth.
  - 6. Bevel hinge and lock door edges 1/8 inch (3 mm) in 2 inches (50 mm). Square edges on hinge and/or lock stiles are acceptable.
  - 7. Reinforce top and bottom of doors with galvanized 16 gauge minimum, welded to both panels.
  - 8. Fire Rating: Supply door units bearing Labels for fire ratings indicated in Door Schedule

for the locations indicated.

9. Core Adhesion System – Basis of design - Moisture Cure Polyurethane Hot Melt:
  - a. Adhesives are to cure completely, meaning once set, they cannot be re-melted and will not soften or freeze and lose adhesion.
  - b. Adhesive system will have an enhanced resistance to flame spread in its cured state designed to pass UL 10C, Positive Pressure Fire Tests of Door Assemblies.
  - c. Bonded assemblies will withstand prolonged exposure from -35°F(-37°C) to 200°F (93°C) temperatures without exhibiting any signs of bond failure.
  - d. Cured adhesive film will remain flexible to allow for differences in thermal expansion and contraction of various substrates without sacrificing bond performance.
10. Core Material
  - a. Treadcore Polystyrene
11. Glass moldings and stops:
  - a. Fabricate from 18-gauge minimum steel:
  - b. Install trim into the door as a four-sided welded assembly with mitered, reinforced and welded corners.
  - c. Trim: identical on both sides of the door.
  - d. Labeled and non-labeled doors: use the same trim to match esthetics.
  - e. Channeling requirements:
    - 1) Cutouts larger than 36" in height require 18-gauge perimeter channelings in the cutout of the door prior to installation of the lite kit our louver.
12. Hardware Reinforcements:
  - a. Doors shall be mortised and adequately reinforced per the manufacturer's guidelines for all hardware. Required mortise hardware reinforcements shall be drilled and tapped at the factory. Surface applied hardware shall be field drilled by hardware installer.
  - b. Hinge reinforcements for full mortise hinges: minimum 7-gauge with an extra-long, high frequency top hinge reinforcement as a standard feature.
  - c. Lock reinforcements: minimum 16-gauge.
  - d. Closer reinforcements: minimum 14-gauge steel.
  - e. Projection welded hinge and lock reinforcements to the edge of the door.
  - f. Provided adequate reinforcements for other hardware as required.

B. Full Flush Doors:

1. Basis of Design: Mesker N Series.

C. Temperature Rise Doors:

1. Basis of Design: Mesker NF-Series Doors.
2. Mineral Fiber Core: Full 1-3/4 inches (45 mm) mineral fiber core material designed to comply with the 250 degrees F (121 degrees C) maximum temperature rise rating.

## 2.4 DOOR FRAMES

A. General: Construct exterior/interior metal door frames to the following designs and gauges;

1. Exterior Frames: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M:
  - a. Thickness:
    - 1) 14 gauge.



2. Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M:
  - a. Thickness:
    - 1) 16 gauge.
3. Interior Frames in stud wall construction: cold rolled steel, ASTM A 1008/A 1008M.
  - a. Thickness:
    - 1) 16 gauge.

B. Flush Steel Frames:

1. Basis of Design: Mesker F-Series.
2. Profile:
  - a. Face:
    - 1) 2 Inches face dimension and types and throat dimensions indicated on the Door Schedule unless noted otherwise.
  - b. Stops:
    - 1) Standard 5/8-inch-high stops
3. Provide reinforcements and accessories for specified hardware per SDI 250.6.
4. Anchors: Locate adjustable anchors in each jamb 6 inches from the top of the door opening to hold frame in rigid alignment.
  - a. Exposed fastener type; recessed hole at base of jamb for countersunk fastener installation.
  - b. Welded in base anchors
5. Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

## 2.5 HOLLOW METAL FRAMING SYSTEMS

A. Hollow Metal Framing Systems:

1. Basis of Design: Mesker S-Series, M-Series.
2. Components: Construct architectural stick frame assemblies of standard frame components, fabricated as specified.
  - a. Exterior and Non-Corrosive Frame Material: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M, 14 gauge galvanized steel.
  - b. Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M, 16 gauge galvanized steel.
  - c. Interior Frames in stud wall construction: 16 gauge cold rolled steel, ASTM A 1008/A 1008M steel.
  - d. Include galvanized components and internal reinforcements with galvanized frames.
3. Frame component requirements:
  - a. Prepare required sticks at door openings and frame assemblies for hardware as specified in Section 087100.
  - b. Fabricate frame assemblies from three basic components:
    - 1) Open Sections (perimeter members) identical in configuration to standard frames.
    - 2) Closed sections (intermediate members) with identical jamb depth, face

- dimensions, and stops as open sections.
  - 3) Sill sections: To be flush with both faces of adjacent vertical members. Cut individual components to length and notched to assure square joints and corners.
  - c. Externally welded face joints at meeting mullions or between mullions and other frame members on the face surfaces only. Grind and finish face joints smooth.
  - d. Fabricate frame assemblies for shipment to the jobsite completely welded.
    - 1) Field joints permissible only when the size of the total assembly exceeds shipping limitations.
    - 2) Fabricate oversized frames in sections designated for splicing in the field.
  - e. Pierced and dimpled glazing beads for use with manufacturers' standard fasteners.
  - f. Provide necessary anchors for jambs, heads, and sills of assemblies.
  - g. Verify field dimensions as required. Do not begin fabrication until these dimensions have been verified and approved.
4. Accessories:
- a. Glazing Bead: Formed steel sheet; screw-attached.
5. Fire Rating: Provide factory assembled welded units bearing Labels for fire ratings indicated on the Drawings.

## 2.6 ACCESSORIES

- A. Anchors: Manufacturer's standard framing anchors, specified in manufacturer's printed installation instructions for project conditions.
- B. Astragals for pairs of doors: Manufacturer's standard for labeled and non-labeled openings.
- C. Plaster Guards: Same material as door frame, minimum 24 gauge (0.5 mm) minimum; provide for all strike boxes. Plaster guards not mandatory on interior after set frames.
- D. Silencers: Resilient rubber, Inserted type, three per strike jamb for single openings. Stick-on silencers shall not be permitted except on hollow metal framing systems.
- E. Glazing: Specified in Section 088000.
- F. All exterior doors and frames are to be prepared to receive future electronics as described in section 087100, Finish Hardware. Prepare interior frames as noted.

## 2.7 FABRICATION

- A. Steel Frames:
  - 1. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
    - a. Clearances shall comply with the requirements of NFPA 80.
  - 2. Factory-welded frames: Head and jamb intersecting corners mitered at 45 degrees, with back welded joints ground smooth.
    - a. Continuous face weld the joint between the head and jamb faces along their length either internally or externally. Grind, prime paint, and finish smooth face joints with no visible face seams.
    - b. Externally weld, grind, prime paint, and finish smooth face joints at meeting mullions or between mullions and other frame members per a current copy of ANSI/SDI A250.8.
  - 3. Provide temporary steel spreaders (welded to the jambs at each rabbet of door openings)

on welded frames during shipment. Remove temporary steel spreaders prior to installation of the frame.

- B. Tolerances shall comply with SDI-117 "Manufacturing Tolerances for Standard Steel Doors and Frames."
- C. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled or hot-rolled steel sheet.
- D. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
- E. Prepare doors and frames to receive mortised and concealed hardware per final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI-107 and ANSI-A115 Series specifications for door and frame preparation for hardware.
- F. All exterior doors and frames are to be prepared to receive future electronics as described in section 087100, Finish Hardware. Prepare interior frames as noted.
- G. Reinforce doors and frames to receive surface-applied hardware per SDI A250.6. Drilling and tapping for surface-applied hardware shall be done at Project site. Provide internal reinforcements for all doors to receive door closers and exit devices where scheduled.
- H. Locate hardware as indicated on Shop Drawings or, if not indicated, per the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

## 2.8 FINISHES

- A. Chemical Treatment: Treat steel surfaces to promote paint adhesion.
- B. Exposed door and frame surfaces to be cleaned and treated then coated with rust inhibitive primer. Water-based primer and color paint finishes to be free of Hazardous Air Pollutants (HAPS) and Volatile Organic Compounds (VOCs). Paint to comply with ANSI A250.3 and A250.10.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that project conditions are acceptable before beginning installation of frames.
  - 1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
  - 2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
- B. Do not begin installation until conditions have been properly prepared.
- C. Correct unacceptable conditions before proceeding with installation.

### 3.2 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's printed installation instructions and with Steel Door Institute's recommended erection instructions for steel frames SDI A250.11 and NAAMM/HMMA 840.
- B. DHI – Door and Hardware Institute – Door Security + Safety Professionals – Installation Guide for Doors and Hardware
- C. Fire Doors and Frames: Install in accordance with SDI A 250.11 and NFPA 80.
  - 1. To ensure compliance with Positive Pressure criteria as required by UBC7-2, UL10C, NFPA5000 and all applicable Local, State and National Code Jurisdictions, all Doors and Frames should be checked for accurate installation per Manufacturers installation instructions to provide proper fire and Smoke Gasketing as tested and listed.
  - 2. Fit hollow-metal doors accurately in frames, within clearances specified in SDI A 250.11 and SDI 100. Install fire rated doors with clearances specified in NFPA 80.

- D. Comply with provisions of SDI-105, "Recommended Erection Instructions for Steel Door Frames," unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
  2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors. Use additional anchors as required for height per manufacturers' installation instructions.
  3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices. Use additional anchors as required for height per manufacturers' installation instructions.
  4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws. Secure Sill Anchors to floor. Use additional anchors as required for height per manufacturers' installation instructions.
  5. Drywall series frames are designed for installation in interior applications after construction of wood or metal stud and drywall applications. Drywall series frames are provided with adjustable jamb lock anchors for secure installation. Install frames per manufacturers' installation instructions. Adjust anchors and secure sill and baseboard anchors as provided.
- E. To comply with the Texas Department of Insurance TDI –
1. Wall Framing Construction: The door assemblies may be mounted to several types of wall framing construction. The types of wall framing construction allowed include:
    - a. Concrete (minimum compressive strength: 3,000 psi)
    - b. Grout filled concrete block
    - c. Hollow concrete block
    - d. Steel (minimum 1/8", Fy = 36 ksi)
    - e. Aluminum (minimum 1/8" thick, 6063-T6)
    - f. Wood (Spruce-Pine-Fir, minimum S.G. = 0.42)
  2. Fastener Requirements:
    - a. Refer to the approved drawings for the anchor layout and notes.
    - b. Refer to the approved drawings for the minimum embedment depths for the fasteners and the minimum edge distances (minimum distance fastener must be from the edge of the substrate material) for the fasteners.
- F. Remove temporary steel spreaders prior to installation of frames.
- G. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete, remove temporary wood spreaders.
1. Field splice only at approved locations indicated on the shop drawings.
  2. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
- H. Provide full height 3/8 inch (9.5 mm) to 1-1/2 inch (38 mm) thick strip of polystyrene foam blocking at frames requiring grouting. Apply the strip to the back of the frame to facilitate field drilling or tapping.
- I. Grouting Hollow Metal Frames:

1. Provide bituminous coating on interior of grout filled jambs.
  2. Provide and install temporary bottom and intermediate wood spreaders to maintain proper width and avoid bowing or deforming of frame members. Refer to ANSI A250.11-2001 and NAAMM/HMMA 840.
  3. Comply with ANSI/SDI Standard A250.8, paragraph 4.2.2, and HMMA 820 TN01 Grouting Hollow Metal Frames, whereby grout will be mixed to provide a 4 inch (102 mm) maximum slump consistency and hand towed into place. Do not use grout mixed to a thinner consistency.
  4. Provide a vertical wood brace during grouting of frame at openings over 4 foot (1219 mm) wide, to prevent sagging of frame header.
- J. Glaze and seal exterior transom, sidelight and window frames in accordance with HMMA-820 TN03.
- K. Apply hardware in accordance with hardware manufacturers' instructions and Section 087100 of these Specifications. Install hardware with only factory-provided fasteners. Install silencers. Adjust door installation to provide 1/8" at head and 1/8" at strike and hinge jamb with door undercut to meet fire ratings and floor conditions to achieve maximum operational effectiveness and appearance.

### 3.3 FIELD QUALITY CONTROL

- A. Fire-Rated Door Assembly Testing:
1. Upon completion of the installation, test each fire door assembly to confirm proper operation of its closing device and verify that it meets all criteria of a fire door assembly per NFPA 80.
  2. Perform inspections by individuals with documented knowledge and understanding of the operation components of the type of door being tested per NFPA 80 and NFPA 101.
  3. Provide a written record to the Owner with copies available to the Authorities Having Jurisdiction (AHJ).
  4. Record shall list the fire door assembly and include the door number with an itemized list of hardware set components for each door opening and location in the facility.

### 3.4 ADJUST AND CLEAN

- A. Adjust doors for proper operation, free from binding or other defects.
- B. Clean and restore soiled surfaces. Remove scraps and debris and leave site in a clean condition.
- C. Prime Coat Touch-Up: Immediately after erection, sand smooth rusted or damaged areas of prime coat, and apply touch-up of compatible air-drying primer.
- D. Properly clean and apply paint to doors and frames in accordance with HMMA-840 TN01 and ANSI A250.8 appendix B along with Manufactures recommended surface preparation for painting.

### 3.5 PROTECTION

- A. Protect installed products and finished surfaces from damage during construction.

END OF SECTION

**SECTION 08 31 00 - ACCESS DOORS AND PANELS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Wall access doors and frames.
- 2. Fire-rated wall access doors and frames.
- 3. Ceiling access doors and frames.
- 4. Fire-rated ceiling access doors and frames.

- B. Related Sections include the following:

- 1. Division 3 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
- 2. Division 7 Section "Roof Accessories" for roof hatches.
- 3. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
- 4. Division 9 Section "Acoustical Tile Ceilings" for access tile in suspended acoustical tile ceilings.
- 5. Divisions 22 & 23 Section "Duct Accessories" for heating and air-conditioning duct access doors.
- 6. Divisions 22 & 23 Section "Storm Drainage Piping" for connection of floor door drainage couplings to drains.

1.3 SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.
- C. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. NFPA 252 or UL 10B for vertical access doors.
  - 2. ASTM E 119 or UBC Standard 7.1 or UL 263 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

#### 1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Access Doors:
    - a. Bilco, Inc. (Floor Access)
    - b. Cesco Products. (Ceiling & Wall Access)
    - c. Dur-red Products. (Floor Access)
    - d. J. L. Industries, Inc. (Ceiling & Wall Access)
    - e. Karp Associates, Inc. (Ceiling & Wall Access)
    - f. Larsen's Manufacturing Company. (Ceiling & Wall Access)

#### 2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.
- C. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to

ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.

- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.
- E. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480/A 480M.
- G. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- H. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- I. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- J. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness.
- K. Plaster Bead: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

## 2.3 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- C. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

## 2.4 ACCESS DOORS AND FRAMES

- A. Flush, Insulated, Fire-Rated Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
  - 1. Locations: wall and ceiling surfaces.



2. Fire-Resistance Rating: one hour.
  3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
  4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
  5. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
  6. Hinges: Continuous piano hinge.
  7. Automatic Closer: Spring type.
  8. Latch: Self-latching bolt operated by flush screwdriver with interior release.
  9. Lock: Key-operated cylinder lock with interior release.
- B. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: wall and ceiling surfaces.
  2. Fire-Resistance Rating: one hour.
  3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
  4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
  5. Frame: Minimum 0.060-inch thick sheet metal with drywall bead.
  6. Hinges: Continuous piano hinge.
  7. Automatic Closer: Spring type.
  8. Latch: Self-latching bolt operated by key with interior release.
  9. Lock: Key-operated cylinder lock with interior release.
- C. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
1. Locations: wall and ceiling surfaces.
  2. Door: Minimum 0.060-inch thick sheet metal, set flush with exposed face flange of frame.
  3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
  4. Hinges: Continuous piano hinge.
  5. Latch: Screwdriver operated cam latch.
  6. Lock: Key-operated cylinder lock.
- D. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: wall and ceiling surfaces.
  2. Door: Minimum 0.060-inch thick sheet metal, set flush with surrounding finish surfaces.
  3. Frame: Minimum 0.060-inch thick sheet metal with drywall bead.
  4. Hinges: Continuous piano hinge.
  5. Latch: Screwdriver operated cam latch.
  6. Lock: Key-operated cylinder lock.
- E. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: wall and ceiling surfaces.
  2. Door: Minimum 0.060-inch thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
  3. Frame: Minimum 0.060-inch thick sheet metal with drywall bead for gypsum board surfaces.
  4. Hinges: Spring-loaded concealed pin type.

5. Latch: Screwdriver-operated cam latch with plastic grommet for access through pan recess.
  6. Lock: Key-operated cylinder lock.
- F. Exterior, Flush Access Doors and Frames: Weatherproof with extruded door gasket.
1. Locations: wall and ceiling surfaces.
  2. Door: Minimum 0.036-inch thick, metallic-coated steel sheet; flush panel construction with 2-inch thick fiberglass insulation.
  3. Frame: Minimum 0.060-inch extruded aluminum.
  4. Hinges: Continuous piano hinge, zinc plated.
  5. Lock: Lockable dual-action handles.
- G. Aluminum, Flush Access Doors and Frames: Fabricated from aluminum sheet and extruded-aluminum shapes with mill finish.
1. Locations: wall and ceiling surfaces.
  2. Door: Minimum 0.080-inch thick aluminum sheet with 3/4-inch polystyrene insulation.
  3. Frame: Minimum 0.060-inch extruded aluminum with 1-1/4-inch wide rolled flange with foam weatherproof gasket.
  4. Hinges: Concealed continuous aluminum.
  5. Latch: Screwdriver-operated cam latch.

## 2.5 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
  2. For trimless frames with drywall bead for installation in gypsum board assembly and gypsum veneer plaster, provide edge trim for gypsum board securely attached to perimeter of frames.
  3. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
  4. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  - 1. For cylinder lock, furnish two keys per lock and key all locks alike.
  - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
  - 3. For doors with latches released by and locks operated by mortise cylinders, prepare access doors for cylinders specified in Division 8 Section "Door Hardware."
- F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## 2.8 METALLIC-COATED STEEL FINISHES

- A. Galvanizing of Steel Shapes and Plates: Hot-dip galvanize items indicated to comply with applicable standard listed below:
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
  - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pretreating.

## 2.9 STEEL FINISHES

- A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

## 2.10 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Polish: No. 4 finish.
  - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

### 3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

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END OF SECTION 08 31 00

(3/06)

## **SECTION 08710**

### **DOOR HARDWARE**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Hardware for swinging, sliding, and folding doors except special types of unique and non-matching hardware specified in other sections.

##### **1.02 RELATED WORK**

- A. Division 8 – Hollow Metal Doors and Frames
- B. Division 8 – Flush Wood Doors

##### **1.03 REFERENCES**

- A. ADA - Americans with Disabilities Act of 1990 including Accessibility Guidelines as amended by the D.O.J. September 15, 2010, as adopted by the Authority Having Jurisdiction (AHJ).
- B. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
- C. ANSI/BHMA A156 (.1 through .21)
- D. ANSI/DHI – A115.1G Installation Guide for Doors and Hardware.
- E. FEMA P-361 – Safe Rooms for Tornadoes and Hurricanes.
- F. NFPA 80 - Fire Doors and Windows.
- G. NFPA 101 – Life Safety Code
- H. IBC - International Building Code, as adopted by public Authority Having Jurisdiction (AHJ).
- I. State and local Rules and Regulations for Barrier Free Facilities, as adopted by AHJ.

##### **1.04 DOOR HARDWARE TYPES**

- A. Types of finish hardware required include, but is not necessarily limited to, the following:
  - 1. Pivot sets and intermediate pivots.
  - 2. Hinges.
  - 3. Lock cylinders.
  - 4. Keys, keying, and key control.
  - 5. Locksets, latchsets, and privacy sets.
  - 6. Exit devices.
  - 7. Closers.
  - 8. Mullions.
  - 9. Overhead, wall, and floor stops.
  - 10. Protection plates.
  - 11. Gasketing for exterior and interior doors, as required.
  - 12. Door holders.
  - 13. Door bottoms.
  - 14. Thresholds.
  - 15. Silencers.
- B. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of door hardware is indicated elsewhere in this section or in the Door Hardware Schedule at the end of this section. Refer to Part 2 Products for Manufacturer's identification and allowable substitutions.

##### **1.05 SUBMITTALS**

- A. Under provisions of Division 1, submit the following:
1. Product information: Manufacturer's published technical product data for all specified door hardware items indicating compliance with the requirements.
  2. Hardware Schedule:
    - a. Hardware schedules are intended for the Contractor's coordination of the work. Review and acceptance by the Architect or Owner does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.
    - b. Submit hardware schedule in the manner and format as specified, complying with the actual construction progress schedule requirements for each draft. Include the following information:
      - 1) Explanation of all abbreviations, symbols, codes, at the like, including door handing.
      - 2) Type, style, function, size, and finish of each hardware item.
      - 3) Door and frame sizes and materials cross referenced to the Architect's marks in the door schedule.
      - 4) Room identification (name and number) on each side of door opening as indicated on the drawings.
      - 5) Product name, model number, description, and name of manufacturer of each item.
      - 6) Fastenings and other pertinent information.
      - 7) Locations of hardware cross referenced to architectural floor plans and door schedules.
      - 8) Mounting heights and locations of each type of hardware.
  3. Key Schedule:
    - a. Require qualified representative of the hardware supplier to personally meet with the Owner and obtain the Owner's written key requirements.
    - b. Include a separate key schedule, showing clearly how the Owner's instructions on keying of locks has been fulfilled.
  4. Samples: Upon request, submit actual material samples of items indicated as for color selection.
  5. Templates: Hardware supplier will furnish hardware templates to the Contractor for each fabricator of doors, frames, and other work to be shop prepared or factory prepared for the installation of hardware. Upon request check shop drawings of such other work, to conform that adequate provisions are made for proper location and installation of hardware.
  6. Provide electrical operation technical sheets including product schematics, point to point diagrams, and electrical requirements of all electrified hardware. Completely coordinate with the general contractor, electrical engineer, electrician, security access subcontractor and the installer. Operational descriptions are for demonstration only – verify operational intent with the owner, architect and electrical engineer.
- B. Under provisions of Division 1 submit the following:
1. Product information.
  2. Hardware schedule.
  3. Manufacturer's published operation and maintenance data. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
  4. Tools and extra materials as required.
  5. Manufacturer's warranties, revised to meet criteria as established within this section. Warranties shall commence upon acceptance of the building by the owner.
  6. Provide physical samples as requested in writing.

## **1.06 QUALITY ASSURANCE**

- A. Acceptable Designs:
1. Items specified in this section are products which are of acceptable design.
  2. Do not substitute other products without Architect's written prior approval per Division 1. Requests for approval shall be submitted by factory authorized distributor firms representing the products proposed for substitution.
- B. Qualifications:
1. Manufacturer: Manufacturers named in Part 2 of this section with not less than 5 years experience in manufacturing commercial door hardware of the type indicated.

2. Hardware Supplier:
    - a. A recognized architectural finish hardware supplier who has been furnishing hardware in the same state as the project for a period of not less than 5 years.
    - b. Hardware supplier's organization shall include an experienced Architectural Hardware Consultant (AHC), certified by the Door and Hardware Institute (DHI), who is physically available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor. Mail or telephone correspondence is not acceptable.
    - c. Hardware supplier shall have local warehousing facilities and shall maintain an adequate parts inventory of items supplied for future service to the owner. Supplier will be a factory authorized distributor of all hardware specified.
    - d. Prior to occupancy, the hardware supplier along with a representative of the manufacturer shall perform a visible and physical inspection of all installed hardware to ensure compliance with the specifications and proper operation. Create a document that confirms both proper or improper conditions and send to the architect and owner's representative.
  3. Installer: Company specializing in installing work of this section with not less than 3 years experience and acceptable to the manufacturer and the hardware supplier. Maintain regular work force of qualified personnel, trained, skilled, and experienced in installing door hardware and constant, competent supervision. The hardware installer shall meet with the representatives of the general contractor and hardware supplier to jointly inventory all hardware items. Upon satisfactory inventory of products, the hardware installer accepts responsibility for all hardware items inventoried.
- C. Regulatory and Operational Requirements:
1. Provide hardware for all openings, whether specified or not, in compliance with NFPA Standard No. 80, proper operation and local building code requirements. Where required, provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Label hardware, as required, for compliance with pressure testing criteria as dictated in IBC.
  2. Provide hardware which meets or exceeds handicap accessibility per local building code requirements. Conform to the Americans with Disabilities Act (ADA) of 1990 as amended by the D.O.J. September 15, 2010, as adopted by the Authority Having Jurisdiction (AHJ).
- D. Warranties:
1. Provide warranty periods that meet or exceed periods noted. Manufacturers that do not meet the required warranty periods shall supply a written statement on the manufacturer's letterhead that the products will be warranted for the required period. All warranty periods commence upon the date of Owner's occupancy with no exceptions.

#### **1.07 DELIVERY, STORAGE, HANDLING, AND PROTECTION**

- A. Deliver, store, handle, and protect products to project site under provisions of Division 1 and as specified herein.
- B. Require hardware supplier to:
  1. Tag each item or package separately, with identification related to final hardware schedule.
  2. Include manufacturer's basic installation instructions with each item or package.
  3. As material is received by hardware supplier from various manufacturers, sort and repackage in containers with each item clearly marked with appropriate opening numbers to match the approved hardware schedule. Two or more identical items may be packed in the same container.
  4. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
  5. Inventory hardware jointly with representatives of the general contractor, hardware supplier and the hardware installer until each is satisfied that count is correct. Refer to paragraph 1.6-B-3.
- C. Protect hardware from theft by cataloging and storing in a secure and lockable area. Control the handling and installation of hardware items which are not immediately replaceable, so that the



completion of the work will not be delayed by hardware losses, both before and after installation. Replace lost, missing, damaged, or stolen door hardware items at no additional cost to the Owner as required to meet schedule requirements.

## **1.08 SEQUENCING AND SCHEDULING**

- A. Coordinate work of this section with the work of other sections of work.
- B. Furnish hardware templates to each fabricator of doors, frames, and other work to be shop or factory prepared for the installation of hardware.
- C. Verify completeness and suitability of door hardware with the hardware supplier and the hardware installer.

## **1.09 MAINTENANCE MATERIALS**

- A. Furnish to Owner a complete set of special wrenches and tools applicable to each different or special hardware component as needed for Owner's continued adjustment, maintenance, removal, and replacement of door hardware.
- B. Tools and accessories shall be supplied by the hardware component manufacturer.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS AND FABRICATION**

- A. General:
  - 1. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.
  - 2. Quantities listed, in any instance, are for the Contractor's convenience only and are not guaranteed.
  - 3. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation. Match the quality and finish of items specified.
  - 4. Provide miscellaneous hardware as listed in hardware groups.
- B. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Door schedule indicates door and frame sizes, materials, required fire ratings, and other pertinent information. Furnish each item of hardware for proper installation and operation of door movement as indicated.
- C. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable name plates), except in conjunction with required UL or FM labels and as otherwise acceptable to the Architect. Manufacturer's identification will be permitted on rim of lock cylinders and latch faceplates only.
- D. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- E. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self tapping sheet metal screws, except as specifically indicated.
  - 1. Screws: Furnish screws for installation, with each hardware item. Provide Phillips flat head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finishes of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
  - 2. Concealed Fasteners: Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed

in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.

## **2.02 HINGES**

- A. Manufacturer:
  - 1. Listed in Door Hardware Schedule: Stanley
  - 2. Substitutions: Hager, McKinney
- B. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template produced units.
- C. Screws: Furnish Phillips flat head or machine screws for installation of units, except furnish Phillips flat head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges.
- D. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - 1. Steel Hinges: Steel pins.
  - 2. Non-ferrous Hinges: Stainless steel pins.
  - 3. Exterior doors: Non-removable pins.
  - 4. Reverse bevel interior doors (lockable): Non-removable pins.
  - 5. Interior doors: Non-rising pins.
- E. Pin Tips: Flat button and matching plug, finished to match leaves.
- F. Number of Hinges: Provide number of hinges indicated, but not less than 3 hinges per door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
- G. Butt type hinges are to be warranted for a period of five years.

## **2.03 LOCK CYLINDERS**

- A. Manufacturer:
  - 1. Listed in Door Hardware Schedule: Best Cormax Patented
  - 2. Approved Substitutions: None – facility standard
- B. All lock cylinders shall be equipped with 7-pin tumbler small format interchangeable core lock cylinders. The interchangeable core shall be removable by a special control key. The control key shall have no cuts in common with grandmaster keys which operate with a shear line completely independent from the shear line of the grandmaster, master, and operating keys. All cores shall have a special limited keyway and shall be removable without removing the cylinder, knob, or core housing of any type lock or lockset. The removable core shall be instantly interchangeable without modification for use in any lock throughout the system. Provide brass construction cores for the construction period. Plastic construction cores are not acceptable. Construction cores shall remain the property of the hardware supplier and will be returned upon incorporation of the permanent key system.
- C. Construct lock cylinder parts from brass/bronze, stainless steel, or nickel silver.

## **2.04 KEYS, KEYING, AND KEY CONTROL**

- A. Keys:
  - 1. Material: Provide keys of nickel silver only.
  - 2. Quantities: These quantities are to establish a maximum allowable quantity of cut keys to service the project and may not necessarily be assigned as noted. A lesser quantity of cut keys required will not result in any credits, nor a quantity of uncut keys to be issued unless noted otherwise.
    - a. 3 change keys per each cylinder unit.
    - b. 5 master keys per master.
    - c. 5 grandmaster keys.
    - d. 3 control keys.
    - e. 3 construction control keys
    - f. 20 construction keys.
  - 3. Deliver keys to the Owner's representative: Send masterkeys to Owner via U.S. registered mail direct from hardware supplier.
- B. Keying:
  - 1. Comply with Owner's written instructions for masterkeying and, except as otherwise indicated, provide individual change keys for each lock which is not designated to be keyed alike with a group of related locks.
  - 2. Grandmaster key all cylinder items to coordinate with the Owner's new masterkey system. Permanently inscribe each key with the notation "DO NOT DUPLICATE".
- C. Key Control:
  - 1. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by the system manufacturer, with capacity for 150% of the number of locks required for the project.
  - 2. Provide a hinged panel type cabinet, for wall mounting, Telkee RWC-75S or equal.
  - 3. Provide cylinder units with concealed key control and keys with visual key control.

## **2.05 LOCKSETS, LATCHSETS, AND PRIVACY SETS:**

- A. Manufacturer:
  - 1. Listed in Door Hardware Schedule: Best 45H
  - 2. Substitutions: Dorma M9000
- B. Types: Locksets, latchsets, and privacy sets as indicated in Door Hardware Schedule.
- C. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt. Provide dust-proof strikes for foot bolts, except where not available. At these locations, provide manufacturer's standard recessed strike. Provide roller type strikes where recommended by lock, latch or bolt manufacturer.
- D. If aluminum frames are specified, confirm with the aluminum frame supplier that the standard lock strikes will function. Provide the manufacturer's standard extended lip strikes if required.
- E. Lock Throw: Provide 3/4" minimum throw of mortise type latches and deadbolts used. Cylindrical latches will be 1/2" minimum. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
- F. Locks and latches shall be warranted for a period of five years.

## **2.06 CLOSERS**

- A. Manufacturer:
  - 1. Listed in Door Hardware Schedule: Stanley QDC
  - 2. Substitutions: LCN 4040XP-DEL
- B. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending on the size of the door, exposure to weather and anticipated frequency of use.

- C. Provide manufacturer's standard through bolt attachment at all applications.
- D. Arms:
  - 1. Provide parallel arms for all overhead closers, except as otherwise indicated. Provide drop plates as needed to prevent glazing interference.
- E. Mount all closers to the maximum allowable degree of opening by the closer manufacturer's template. Where closer arms incorporate dead stop features, mount closers to the maximum degree of opening available before conflict with adjacent structures. If not apparent on the contract documents, verify the use of open space with the Architect or Owner's Representative to determine the maximum allowable degree of opening.
- F. Access Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provision for door opening force. Fire protection has precedence over handicap compatibility, check with local jurisdiction.
- G. Include the manufacturer's adjustable delayed action on all closers.
- H. Door closers and related hardware shall be warranted for a period of twenty-five years.

## **2.07 WALL AND FLOOR STOPS**

- A. Manufacturers:
  - 1. Listed in Door Hardware Schedule: Trimco
  - 2. Substitutions: Rockwood, Hager
- B. General: Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.
- C. Import products lesser in quality than the specified items are not acceptable.

## **2.08 PROTECTION PLATES**

- A. Manufacturers:
  - 1. Listed in Door Hardware Schedule: Trimco
  - 2. Substitutions: Hager, Tice
- B. Types: Armor Plates, Kick Plates, Mop Plates
- C. Fasteners: Provide manufacturer's standard exposed and countersunk Phillips head fasteners for door trim units; either machine screws or self tapping sheet metal type screws per manufacturer's recommendations for application to the specified door construction.
- D. Sizes: Fabricate protection plates (armor, kick or mop) not more than 2" less than door width on stop side and not more than 1" less than door width on pull side, x the height indicated.
- F. Metal Plates: Stainless Steel, 18 gauge (0.050) thick. Satin finish, US32D (630), beveled four edges (B4E).

## **2.09 GASKETS AND SWEEPS**

- A. Manufacturer:
  - 1. Listed in Door Hardware Schedule: National Guard
  - 2. Substitutions: Pemko, Reese
- B. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf. Provide type, sizes and profiles indicated as drawn or scheduled.
- C. Fasteners: Provide non-corrosive fasteners as recommended by the manufacturer for applications indicated.
- D. Replaceable seal strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by the manufacturer.
- E. Perimeter weatherstripping: Flexible, hollow neoprene bulb or loop insert, conforming to MIL R 6055, Class II, Grade 40. Where two types of perimeter gaskets are specified, apply them not to conflict and per gasket manufacturer's recommendations.

- F. Weatherstripping at Door Bottoms: Provide door bottoms consisting of contact type resilient insert and metal housing of design and size indicated.
- G. Hot smoke seal, if required by IBC and subsequent UL testing procedures, will be supplied as an integral part of the door assembly by the door manufacturer.
- H. Gaskets and sweeps shall be warranted for a period of three years.

## **2.10 SILENCERS**

- A. Manufacturers:
  - 1. Listed in Door Hardware Schedule: Trimco
  - 2. Substitutions: Rockwood, Ives

## **2.11 FINISHES**

- A. Exposed surfaces of building shell and core shall be Brushed Chrome (626, 652) or Satin Stainless Steel (630). Items specified in Satin Stainless Steel (630) shall be supplied in stainless steel with no exceptions.
- B. The designations used in the schedule and elsewhere to indicate hardware finishes are the industry recognized standard commercial finishes common to the product's manufacturer listed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine and verify that substrates and project site conditions are ready to receive work of this section.
- B. Do not begin installation until finishes indicated to be field applied have been applied to doors, frames, and similar items requiring project site finishing and are thoroughly dry and cured.
- C. Do not begin installation until unsatisfactory conditions are corrected in a manner acceptable to the installer. Beginning installation means installer accepts project site conditions and substrates as ready to receive work of this section.

### **3.02 INSTALLATION**

- A. General: The types and approximate quantities of door hardware required for this project are indicated at the end of this section.
- B. Key Cabinet: Installation will be done by the owner.
- C. Heights: Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the Architect.
- D. Substrates: Adjust and reinforce attachment substrates as necessary for proper installation and operation of hardware.
- E. Installation:
  - 1. Install each hardware item in compliance with the manufacturer's instructions, as adopted by local jurisdiction, requirements of NFPA 80, NFPA 101, IBC, ADA, State and local Rules and Regulations for Barrier Free Facilities and recommendations of the DHI.
  - 2. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
  - 3. Drill and countersink units which are not factory prepared for fasteners. Space fasteners and anchors in accordance with industry standards.
  - 4. Where not factory machined, machine cut for hardware per template, as required.
  - 5. Cut and fit thresholds and floor covers to profile of door frames. Join units with concealed welds. Cut smooth openings for spindles, bolts, or similar items. Screw thresholds to substrate with the manufacturer's standard flat head sleeve anchors (FHSL 14), 1/4-20 unless noted otherwise. Fill cavities of thresholds at sound rated openings with 1 inch thick (uncompressed thickness) low

density fiberglass sill sealer insulation full width and length of the threshold. In addition to fastening requirements, set thresholds for exterior doors in a full bed of butyl-rubber or polyisobutylene mastic sealant.

6. Do not install hardware which is incomplete or apparently improper for application. Notify the hardware supplier immediately of any such deficiencies. Failure to comply with this requirement indicates the hardware installer's acceptance of responsibility for proper application and performance.
- F. Cutting and Patching:  
Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections.
- G. Where electronics are specified for integration with the security access system, operation notes are for opening options that may or may not be utilized by the owner. Consult with the owner and security access subcontractor for final operation parameters.

### **3.03 ADJUSTING**

- A. Initial Adjustment:
  1. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Adjust resilient faced sound stops for continuous contact with door and threshold. Adjust weatherstripping and sweeps to completely seal doors with frames and to adjacent structures.
  2. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

### **3.04 DEMONSTRATION**

- A. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

### **3.05 CLEANING AND DEBRIS**

- A. Cleaning:
  1. Clean work upon installation.
  2. Clean adjacent surfaces soiled by work of this section.
- B. Debris: Remove debris from project site and legally dispose of off-site.

### **3.06 MAINTENANCE**

- A. Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
  1. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
  2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
  3. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
  4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

### 3.07 PROTECTION

- A. Protect work of this section as required so that work will be without damage or deterioration at the time of completion and acceptance by the Owner.

### 3.08 DOOR HARDWARE SCHEDULE

#### Manufacturer's Abbreviations

|    |                     |                   |
|----|---------------------|-------------------|
| BE | Best Access Systems | Cylinders, Locks  |
| KN | Knox                | Access Key Box    |
| NA | National Guard      | Gaskets           |
| ST | Stanley             | Hinges, Closers   |
| TK | Telkee              | Key Cabinet       |
| TR | Trimco              | Stops, Flat Goods |

#### Finish List

|         |                       |
|---------|-----------------------|
| 626/652 | Satin Chrome Plated   |
| 630     | Satin Stainless Steel |
| 689     | Painted Aluminum      |
| BLK     | Black                 |
| GREY    | Grey                  |

#### Option List

|            |  |
|------------|--|
| VIN        | Occupancy Indicator                                    |
| N Mounting | Spanner Through Bolt Mounting (Trimco)                 |
| L Mounting | Spanner BTB Mounting (Trimco)                          |
| B4E        | Beveled 4 Edges – Kick, Mop and Armor Plates (Trimco)  |
| CS         | Counter Sinking of Kick, Mop and Armor Plates (Trimco) |

#### Miscellaneous Hardware – supply the following in addition to specified items:

|                              |              |                   |     |    |
|------------------------------|--------------|-------------------|-----|----|
| 4                            | Cormax Cores | 1CX-7 PATD        | 626 | BE |
| 2                            | Closers      | QDC111 Tri Packed | 689 | ST |
| 1                            | Knox Box     | 3200              | 628 | KN |
| 1                            | Key Cabinet  | RWC-75S           |     | TK |
| Locate Knox box as directed. |              |                   |     |    |

#### SET #1 – Boiler Area

|   |                |                         |      |    |
|---|----------------|-------------------------|------|----|
| 3 | Hinges         | CB179 4 1/2 X 4 1/2 NRP | 652  | ST |
| 1 | Lockset        | 45H-7D14M PATD          | 626  | BE |
| 1 | Wall Bumper    | 1270CVPV                | 626  | TR |
| 3 | Door Silencers | 1229A                   | GREY | TR |

END OF SECTION

## **SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:

- 1. Interior gypsum wallboard.
- 2. Tile backing panels.
- 3. Fiberboard tack base.
- 4. Vinyl tackboard wall paneling.

- B. Related Sections include the following:

- 1. Division 6 Section "Rough Carpentry" for wood framing and furring, and gypsum sheathing applied over wood framing.
- 2. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
- 3. Division 9 Section "Factory-Finished Gypsum Board" for gypsum board with a factory-applied decorative film.
- 4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for framing, gypsum panels, and other components of shaft wall assemblies.
- 5. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.

#### **1.3 DEFINITIONS**

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

#### **1.4 SUBMITTALS**

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

#### **1.5 QUALITY ASSURANCE**

- A. Single Source: Obtain gypsum board products from a single manufacturer, or from manufacturer's recommended by the prime manufacturer of gypsum board.



- B. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory." and GA-600, "Fire Resistance Design Manual".
- C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
  - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
- D. Gypsum Board Terminology Standard: GA-505.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends and surfaces. Protect metal corner beads and trims from being bent or damaged.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
  - 1. Cold Weather Protection: When ambient outdoor temperatures are below 55 degrees F, maintain continuous, uniform, comfortable building working temperatures of not less than 55 degrees F for a minimum of 48 hours prior to, during and following application of gypsum board and joint treatment or bonding of adhesives.
  - 2. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of the following:

1. Gypsum Board and Related Products:
  - a. American Gypsum Co.
  - b. Domtar Gypsum
  - c. Flintkote Products, Genstar Building Materials Co.
  - d. G-P Gypsum Corp.
  - e. Gold Bond Building Products Div., National Gypsum Company.
  - f. United States Gypsum Co.
  - g. Pabco
2. Direct Suspension Systems:
  - a. Chicago Metallic Corp.
  - b. Donn Corporation
  - c. United States Gypsum Co.

## 2.2 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.
  1. Regular Type:
    - a. Thickness: 5/8 inch, unless otherwise indicated.
    - b. Long Edges: Tapered.
    - c. Location: As indicated.
  2. Type X:
    - a. Thickness: 5/8 inch, unless otherwise indicated.
    - b. Long Edges: Tapered.
    - c. Location: Where required for fire-resistance-rated assembly.
- C. Flexible Gypsum Wallboard: ASTM C 36, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.
  1. Thickness: 1/4 inch.
  2. Long Edges: Tapered.
  3. Location: As indicated. Apply in double layer at curved assemblies.
- D. Gypsum Backing Wallboard for Multi-Layer Application: ASTM C 442.
  1. Core: 5/8 inch, regular type and 5/8 inch, Type X for rated assemblies.
  2. Long Edges: Manufacturer's standard.
  3. Location: As indicated.
- E. Proprietary Abuse-Resistant Gypsum Wallboard: ASTM C 36, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.
  1. Products: Subject to compliance with requirements, provide one of the following:

- a. National Gypsum Company; Gold Bond Hi-Abuse Wallboard.
- b. United States Gypsum Co.; SHEETROCK Brand Abuse-Resistant Gypsum Panels.

2. Core: 5/8 inch, regular type and 5/8 inch, Type X for fire rated assemblies.

F. Moisture and Mold Resistant Gypsum Backing Board: ASTM C 1396.

1. Core: 5/8 inch, regular type and 5/8 inch, Type X for fire rated assemblies.

## 2.3 BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M.

1. Product: Subject to compliance with requirements, provide "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.
2. Core: 5/8 inch, regular type and 5/8 inch, Type X at fire rated assemblies.

C. Cementitious Backer Units: ANSI A118.9.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Custom Building Products; Wonderboard.
  - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
  - c. United States Gypsum Co.; DUROCK Cement Board.

2. Thickness: 1/2 inch, unless otherwise indicated.

D. Fiberboard Tack Base (for vinyl wall covering specified elsewhere): Fed. Spec. LLL-1-535.

1. Products:
  - a. United States Gypsum Corp.
2. Thickness: 1/2 inch thick. Primed and ironed.
3. Flame Spread: 25
4. Smoke Developed: 10
5. ASTM E84: Meets or exceeds (Class A).

E. Prefinished Vinyl Covered Tackboard Wall Paneling: ASTM E-84-87.

1. Products:
  - a. Lamvin, Inc. 760. 806.6400
  - b. Chatfield Clark. 909.823.4297
2. Thickness: 1/2 inch by 48 inches by full height
3. Flame Spread: Class II – 75 or less.
4. Trims: "L" angle, "H" bead, "J" bead and etc., as manufactured by panel manufacturer.

## 2.4 TRIM ACCESSORIES

### A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead: Use at outside corners, unless otherwise indicated.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
  - c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
  - d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use where indicated.
  - e. Expansion (Control) Joint: Use where indicated.
  - f. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

### B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fry Reglet Corp.
  - b. Gordon, Inc.
  - c. MM Systems Corporation.
  - d. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified, unless otherwise indicated.

## 2.5 JOINT TREATMENT MATERIALS

### A. General: Comply with ASTM C 475.

### B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

### C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
3. Cementitious Backer Units: As recommended by manufacturer.

## 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Gypsum Board Nails and Screws: Comply with ASTM C-840.

E. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

- F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

- G. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

- H. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

- I. Gypsum Board Nails and Screws: ASTM C-840

- J. Resilient Channels: USG RC-1.
- K. Concealed Acoustical Sealant: Non-drying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant for concealed applications per ASTM C 919.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

#### 3.3 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216. Comply with 2010 CBC Section 2508.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
  - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

### 3.4 PANEL APPLICATION METHODS

- A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- F. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- G. Tile Backing Panels:
1. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
  2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at other locations indicated to receive water-resistant panels.
  3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.
- H. Fiberboard Tack Base: Install over gypsum backing board with adhesive with either nails or screws as required, with approximately 1/8 inch space at joints. Where installed over concrete or masonry substrate, nail with concrete nails to hold for adhesive.



### 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings. If not shown, install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

### 3.6 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
  - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
  - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where indicated.
  - 3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where indicated.
  - 4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
  - 5. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.7 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching Architect approved mockup and free of starved spots or other evidence of thin application or of application patterns.

- A. Skip-Trowel Texture shall be applied to all gypsum board surfaces to be painted. Provide mock up for review and approval by Architect on a 2'x2' gypsum board.

- OR-

- B. Spray Knock-Down Texture shall be applied to all gypsum board surfaces to be painted. Provide (3) different textured samples for review and approval by Architect on a 2'x2' gypsum board.

- B. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

### 3.8 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
  - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
  - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
    - a. Installation of 80 percent of lighting fixtures, powered for operation.
    - b. Installation, insulation, and leak and pressure testing of water piping systems.
    - c. Installation of air-duct systems.
    - d. Installation of air devices.
    - e. Installation of mechanical system control-air tubing.
    - f. Installation of ceiling support framing.

### 3.9 PROTECTION

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION 09 21 16

(9-2-08/jm)

**SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Related Sections include the following:
  - 1. Division 9 Section "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

**1.3 DEFINITIONS**

- A. LR: Light Reflectance coefficient.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Coefficient
- D. CAC: Ceiling Attenuation Class

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For components with factory-applied color finishes.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- D. Qualification Data: For testing agency.

- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- F. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.
- G. Maintenance Data: Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances. Resubmit at closeout. *(Project Close-Out Item)*

## 1.5 QUALITY ASSURANCE

- A. Comply with 2016 CBC Section 2506.2.1 and DSA IR 25-2.13.
- B. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- C. Source Limitations:
  - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
  - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Flame Spread: 25 or less.
    - b. Smoke-Developed Index: 50 or less.
- E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  - 1. CBC Section 1613A, "Earthquake Loads."

2. ASCE 7-10, Section 13.5.6, "Suspended Ceilings."

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS *(Project Close Out-Item)*

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
- C. Panel-Based Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

### 2.3 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING - APC-A

- A. Products:
  - 1. Armstrong World Industries, Inc; Fine Fissured #1830
  - 2. Armstrong World Industries, Inc; Cortega Second Look #2758
  - 3. Armstrong World Industries; Fine Fissured #1811.
  - 4. Armstrong World Industries; Fine Fissured #1820.
- B. Color: White.
- C. LR: Not less than 0.82.
- D. NRC: Not less than 0.50 - 0.60.
- E. CAC: 35 - 40.
- F. Edge Detail: Square.
- G. Thickness: 15/16 inch.
- H. Size: 24 by 48 inches.

- I. Antimicrobial Treatment: Panel based.
- 2.4 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS WITH MEMBRANE-FACED OVERLAY FOR ACOUSTICAL PANEL CEILING - APC-B
- A. Products:
    - 1. Armstrong World Industries, Inc; Mylar #1716
  - B. Color: White.
  - C. LR: Not less than 0.74.
  - D. NRC: .65.
  - E. CAC: .35.
  - F. Flame Spread: 0-25.
  - G. Edge Detail: K4C4.
  - H. Thickness: 3/4 inch.
  - I. Size: 24 by 48 inches.
  - J. Antimicrobial Treatment: Coating based.
- 2.5 METAL EDGE MOLDINGS AND TRIM
- A. Manufacturers:
    - 1. Armstrong World Industries, Inc.
    - 2. Chicago Metallic Corporation.
    - 3. Donn Corporation
  - B. Sheet-Metal or Plastic Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
- 2.6 ACOUSTICAL SEALANT
- A. Products:
    - 1. Acoustical Sealant for Exposed and Concealed Joints:
      - a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
      - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
    - 2. Acoustical Sealant for Concealed Joints:

- a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
  - b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
  - c. Pecora Corp.; BA-98.
  - d. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

#### 3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension



- members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of four tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  6. Do not attach hangers to steel deck tabs.
  7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 6 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  3. Unless unavoidable, do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
    - a. Install panels with pattern running in one direction.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
  5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

(08/08)

## **SECTION 09 67 10 – EPOXY FLOORING**

### **PART 1 - GENERAL**

#### **1.1 Summary**

- A. This Section includes:
  - 1. High-performance resinous flooring systems.

#### **1.2 Submittals**

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

#### **1.3 Quality Assurance**

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
  - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
  - 2. Installer Letter of Certification: Installer to provide letter stating that they have been in business for at least 10 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.

- D. **Mockup:** Apply mockup to verify selection made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
  2. Simulate finished lighting conditions for Architect's review of mockups.
  3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  4. Mockup shall demonstrate desired slip resistance for review and approval by General Contractor prior to installing project areas.

#### 1.4 Delivery, Storage, And Handling

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

#### 1.5 Project Conditions

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

### PART 2 - PRODUCTS

#### 2.1 Manufacturers

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. The Sherwin-Williams Company General Polymers Brand
  2. Or approved equal.

## 2.2 Materials

- A. The General Polymers URETHANE SLURRY FLOORING SYSTEM as manufactured by Sherwin-Williams with Cove consists of 4040 *FasTop* Urethane Primer (Cove), 4060 *FasTop* Cove Base Binder Resin, and 5055 *FasTop* Cove Base Aggregate (Cove), 3477 Epoxy Water Emulsion Primer Sealer as primer for outgassing, 4080 *FasTop* 12S Binder Resin, with 5080 *FasTop* 12S Aggregate as slurry, 5310-8 Dry Silica Sand (20-40 Mesh or larger) for broadcast and 4090TC *FasTop* 12 TC/M-Urethane Top Coating /5095 *FasTop* 12 TC AGGREGATE as an optional seal coat at a ¼" nominal.
- B. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
  - 1. Resinous Flooring: 100 g/L.

## 2.3 High-Performance Resinous Flooring

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.
- B. System Characteristics:
  - 1. Color: **Sherwin Williams SW 7649 Silverplate**
  - 2. Pattern: As indicated from manufacturers listed above.
  - 3. Slip Resistance: Provide slip resistant finish.
  - 4. Cove: 4"
  - 5. Corner Radius: 3/8"

## PART 3 - EXECUTION

### 3.1 Preparation

- A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces. Test and report for moisture level in substrate to verify compliance with manufacturer's requirements. Do not proceed unless acceptable test results are achieved.
- B. Only installers approved by the manufacturer in writing shall perform installation of the material.
- C. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or

approved mechanical means (acid etch not allowed). If surface is questionable try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:

- |   |                |
|---|----------------|
| 1. Thin film, to 10 mils                  | CSP-1 to CSP-3 |
| 2. Thin and medium films, 10 to 40 mils   | CSP-3 to CSP-5 |
| 3. Self-leveling mortars, to 3/16"        | CSP-4 to CSP-6 |
| 4. Mortars and laminates, to 1/4" or more | CSP-5 to CSP-9 |

### 3.2 Environmental Conditions

- A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly instructions shall be implicitly followed.
- B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions by using the following methods as recommended by the resinous flooring manufacturer.
  - 1. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. or that required in manufacturer's instructions of slab area in 24 hours.
  - 2. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
  - 3. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a percent relative humidity level measurement as noted acceptable by resinous floor manufacturer.
- D. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- E. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- F. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- G. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

### 3.3 Applications

- A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
  - 1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
  - 2. Install topcoat over flooring after excess aggregate has been removed.
  - 3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping.
- B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
- D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- E. Slip Resistant Finish: Provide grit for slip resistance.
- F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

### 3.4 Completed Work

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

END OF SECTION 09 67 10

**SECTION 09 91 00 – PAINTING**

**Manufacturers and Products**

Substitutions or Alternates *not permitted* without District Approval

**PARTS 1 - GENERAL**

**1.01 SUMMARY:**

- A. Section Includes: Painting and finishing of all interior and exterior items and surfaces, unless otherwise indicated or listed under exclusions below:
  - 1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated.
  - 2. Include field painting of exposed exterior and interior plumbing, mechanical and electrical work, except as indicated below.
  - 3. Paint exterior stucco where indicated on Drawings.
- B. Work Included:
  - 1. The intent and requirements of this section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.
- C. The following general categories of work and items that are included under other sections, shall not be a part of this section:
  - 1. Shop prime painting of structural and miscellaneous iron or steel.
  - 2. Shop prime painting of hollow metal work.
  - 2. Shop finished work and items.
- D. The Finish Schedules indicated on the drawings, indicates the location of interior room surfaces to be painted or finished. The schedule indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

**1.02 SUBMITTALS:**

- A. Product Data: Submit complete manufacturer's descriptive literature and specifications in accordance with the provisions of Division 1.
  - 1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and coating materials proposed for use, which equates such materials with the design-basis products specified.
- B. Samples: In accordance with provisions of Division 1, submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture and material selected by the Architect from standard colors available for the coatings required.



1. For natural and stained finishes, provide sample on each type and quality of wood used on the project.

- C. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

#### 1.03 QUALITY ASSURANCE:

- A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.

1. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).

- B. Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

#### 1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.
- B. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

#### 1.05 PROJECT CONDITIONS:

- A. Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS:

- A. Manufacturer's catalog names and number of paint types in this Section herein are based on products of Dunn-Edwards Corporation. This is a district standard and is not eligible for substitution.

#### 2.02 MATERIALS:

- A. Paints: Provide Ready-Mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.

- B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.
- C. Colors as identified in the project documents.
  - a. DEW 324 – “Phoenix Vanilla”
  - b. DE 5372 – “Sheep Skin”
  - c. DE 5656 – “Wreath”
  - d. DE 6229 – “Calico Rock”
- D. Anti-Graffiti Sealant
  - a. “This Stuff Works” TSW2R 24

2.04 MIXES:

- A. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

PART 3-EXECUTION

3.01 EXAMINATION:

- A. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain, other specified finish shall be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
- B. Beware of a condition known as "critical lighting". This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any corrective action to gypsum board/drywall must be done by the drywall contractor prior to decorating.

3.02 PROTECTION:

- A. Protect previously installed work and materials, which may be affected by Work of this Section.
  - 1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
  - 2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
  - 3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.
- B. Provide WET PAINT signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.03 PREPARATION:

- A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
- B. Concrete and masonry surfaces shall be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete shall be roughened or etched to uniform texture.

- C. Ferrous metal shall be cleaned of oil, grease, and foreign matter with solvent. Prime within 3 hours after preparation.
- D. Sand and scrape metal to remove loose primer and rust.
- E. Galvanized metal shall be chemically or solvent cleaned and then retreated with an etching-type solution if recommended by the finish manufacturer. Cleaned and retreated galvanized metal shall be primed the same day that cleaning has been performed.
- F. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks and other defects after priming and spot prime repairs when fully cured.
- G. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- H. Existing surfaces to be recoated shall be thoroughly cleaned and deglossed by sanding or other means prior to painting. Patched and bare areas shall be spot primed with same primer as specified for new work.
- I. Thoroughly backpaint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, cabinetwork, etc., which will be concealed after installation. Backpaint items to be painted or enameled with the priming coat. Use a clear sealer for backpriming where transparent finish is required.
- J. Bar and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work shall be cleaned prior to priming.
- K. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
- L. Bond breakers and curing agents must be removed and the surface cleaned before primers, sealers or finish paints can be applied.
- M. All drywall surfaces must be completely dry and dust free before painting. Skim coated drywall must be sealed with an alkyd based sealer or a waterborne sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.

#### 3.04 APPLICATION:

- A. Apply painting and finishing materials in accordance with the manufacturer's submittals, as approved. Use applicators and techniques best suited for the material and surfaces to which applied.
  - 1. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
  - 2. All undercoats shall be tinted slightly to approximate the color of the finish coat.
- B. Apply each material at not less than the manufacturer's recommended spreading rate:
  - 1. Provide a total dry film thickness of not less than 1.2 mils for each required coat.

- C. Apply prime coat to surface, which is required to be painted or finished.
- D. Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.
- E. Sand lightly and dust clean between succeeding coats.

3.05 CLEANING, TOUCH-UP AND REFINISHING:

- A. Carefully remove all spattering, spots and blemishes caused by work under this section from surfaces throughout the project.
- B. Upon completion of painting work remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.
- C. Runs, sags, misses, holidays, stains and other defects in the painted surfaces, including inadequate coverage and mil thickness shall be satisfactorily touched up, or refinished, or repainted as necessary.

3.06 FINISH SCHEDULE

- A. Apply the following finishes to the surfaces specified and/or as specified on the painting schedule on the Drawings. Apply all materials in accordance with manufacturer's instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.
  - 1. As noted in plans
  - 2. Semi-gloss finish typical, all materials, interior and exterior.
  - 3. District approval required to substitute for semi-gloss, even if the non-semi-gloss finish is noted below.
- B. Exterior Systems:
  - 1. Stucco & Plaster
    - Semi-Gloss – 100% Acrylic

|             |   |
|-------------|---|
| First Coat  | EFF-STOP, Acrylic Masonry Primer (W 709)                        |
| OR          | SUPER-LOC Two-Component Waterborne Epoxy Masonry Sealer (W 718) |
| Second Coat | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)            |
| Third Coat  | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)            |
  - 2. Concrete Tilt-Up
    - Semi-Gloss – 100% Acrylic

|             |   |
|-------------|---|
| First Coat  | EFF-STOP, Acrylic Masonry Primer/Sealer (W 709)                 |
| OR          | SUPER-LOC Two-Component Waterborne Epoxy Masonry Sealer (W 718) |
| Second Coat | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)            |
| Third Coat  | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)            |

4. Ferrous Metal

a. Semi-Gloss – Alkyd/Acrylic

|             |  |
|-------------|--|
| First Coat  | SYN-LUSTRO, Water-based Rust-Preventative Acrylic Primer (W 8) |
| OR          | BLOC-RUST, Red Oxide Alkyd Rust Preventative Primer (43-4)     |
| OR          | CORROBAR, White Alkyd Rust Preventative Primer (43-5)          |
| Second Coat | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)           |
| Third Coat  | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)           |

5. Galvanized Metal

a. Semi-Gloss – Alkyd/Acrylic

|              |   |
|--------------|---|
| Pretreatment | JASCO Metal Etch  |
| First Coat   | GALV-ALUM Epoxy Galvanized/Aluminum Metal Primer (43-7) |
| Second Coat  | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)    |
| Third Coat   | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50)    |

6. Wood – Paint Finish

a. Semi-Gloss – Acrylic

|             |  |
|-------------|--|
| First Coat  | E-Z PRIME, Ext. 100% Acrylic Wood Primer (W 708)     |
| Second Coat | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50) |
| Third Coat  | EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH 50) |

C. Interior Systems:

1. Gypsum Board

a. Semi-Gloss - Acrylic

|             |   |
|-------------|---|
| First Coat  | VINYLASTIC, Interior Pigmented Sealer (W 101V)*   |
| Second Coat | SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50) |
| Third Coat  | SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50) |

2. Concrete & Plaster:

a. Semi-Gloss – 100% Acrylic

|             |   |
|-------------|---|
| First Coat  | SUPER-LOC, Two-Component Waterborne Epoxy Sealer (W718) |
| OR          | EFF-STOP, Acrylic Masonry Primer (W 709)                |
| Second Coat | SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50)       |
| Third Coat  | SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50)       |

3. Ferrous Metal

a. Semi-Gloss – Alkyd/100% Acrylic

|             |  |
|-------------|--|
| First Coat  | SYN-LUSTRO, Water-based Rust-Preventative Acrylic Primer (W 8) |
| OR          | CORROBAR, White Alkyd Rust Preventative Primer (43-5)          |
| Second Coat | SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50)              |

Third Coat SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50)

b. Semi-Gloss –Rust Preventative Alkyd

First Coat SYN-LUSTRO, Water-based Rust-Preventative Acrylic Primer (W 8)

OR CORROBAR, White Alkyd Rust Preventative Primer (43-5)

Second Coat SYN-LUSTRO, Alkyd Rust Preventative Semi-Gloss Enamel (9)\*\*

Third Coat SYN-LUSTRO, Alkyd Rust Preventative Semi-Gloss Enamel (9)\*\*

OR SYN-LUSTRO Water-based Rust-Preventative Acrylic Semi-Gloss Paint (W9)

4. Wood – Paint Finish

a. Semi-Gloss – 100% Acrylic

First Coat UNIKOTE, Int. Acrylic Enamel Undercoater (W707V)

Second Coat SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50)

Third Coat SUPREMA, 100% Acrylic Semi-Gloss Enamel (SPMA 50)

END OF SECTION 09 91 00

## **SECTION 22 00 00**

### **PLUMBING GENERAL REQUIREMENTS**

#### **PART 1 – GENERAL**

##### **1.1 CONDITIONS AND REQUIREMENTS**

- A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

##### **1.2 SCOPE OF WORK**

- A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.
- B. Consult all other Sections to determine the extent of this work specified elsewhere.
- C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

##### **1.3 REGULATIONS AND STANDARDS**

- A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:
  - 1. California Building Code
  - 2. California Electrical Code
  - 3. California Plumbing Code
  - 4. California Mechanical Code
  - 5. California Energy Code
  - 6. California Green Buildings Standard
  - 7. California Fire Code
  - 8. National Fire Protection Association

##### **1.4 QUALITY ASSURANCE**

- A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner's insurance underwriter.
- B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.
- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

- D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

#### **1.5 SAFETY**

- A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities within Contractor's scope of work.

#### **1.6 PERMITS, FEES, AND UTILITIES**

- A. Secure and pay for all permits, licenses, inspections, and fees required.
- B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

#### **1.7 PAINTING**

- A. Paint all exposed piping and supports.
- B. See Division 09 for painting.

#### **1.8 COORDINATION**

- A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.
- B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.
- C. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.
- D. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.



- E. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.
- F. Pipes which pitch have right-of-way over those which do not pitch. For example, condensate drains and waste normally have right-of-way.
- G. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

## **PART 2 – PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS**

- A. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.
- B. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.
- C. Furnish all materials and equipment of the same type by the same manufacturer.

### **2.2 ALTERNATE EQUIPMENT AND MATERIALS**

- A. No substitute materials or equipment may be installed without the written approval of the Architect.
- B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.
- C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.
- D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

### **2.3 SUBMITTALS**

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

- C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.
- D. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.
- E. Submittals will be returned to indicate appropriate action taken as follows:
  - 1. No Exceptions Taken.
  - 2. Make Corrections Noted. No Resubmittal Required.
  - 3. Revise and Resubmit.
  - 4. Rejected.
  - 5. Not Reviewed.
- F. Use electronic form acceptable to Architect for electronic submittals, containing the following information:
  - 1. Project name.
  - 2. Date.
  - 3. Name and address of Architect and Engineer.
  - 4. Name of Owner.
  - 5. Name, address and contact information of Contractor.
  - 6. Names and contact information of sub-contractor, manufacturer, and supplier.
  - 7. Name of entity that prepared submittal.
  - 8. Category and type of submittal.
  - 9. Specification Section number and title.
  - 10. Drawing number and detail references, as appropriate.
  - 11. Transmittal number, numbered consecutively, and revision number clearly identified.
  - 12. Each item submitted labeled or identified the same as on the drawings.
- G. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.
- H. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.
- I. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.
- J. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION OF SITE**

- A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

### **3.2 DRAWINGS**

- A. Drawings show general arrangement and location of piping and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of piping. Field verify all dimensions.
- B. The exact locations of equipment and piping shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost.
- C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.
- D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

### **3.3 RECORD DRAWINGS**

- A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.
- B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.
- C. Record drawings must include the following as a minimum:
  - 1. Actual equipment locations.
  - 2. Revisions or substitutions to equipment schedules.
  - 3. Pipe size and routing.
  - 4. Dimensional changes to drawings.
  - 5. Revisions to details shown on drawings.
  - 6. Changes made by RFIs, Addenda, or Change Orders.

7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.

### **3.4 PROTECTION OF BUILDING**

- A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

### **3.5 DELIVERY, DRAYAGE AND HAULING**

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.
- B. Provide proper protection and storage of all items and tools required.
- C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

### **3.6 EQUIPMENT AND MATERIAL PROTECTION**

- A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.
- C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.
- D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.
- E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.
- F. Do not operate water systems until piping has been cleaned, disinfected and start-up strainers are in place.

### **3.7 QUALITY OF WORK**

- A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.
- B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

### **3.8 FURRING AND PIPE SPACES**

- A. Spaces provided in the design of the building shall be utilized and the work shall be kept within the furring lines established on the Drawings.
- B. Ensure necessary clearances on trim plates at exposed penetrations of walls and floors. If sufficient room is not available above suspended ceiling or vertical shafts obtain clarification from Architect before work is started.

### **3.9 CUTTING AND PATCHING**

- A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.
- B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.
- D. Provide sleeves for all piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and piping. When piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

### **3.10 ACCESS**

- A. Indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.
- B. No controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.
- C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.
- D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.
- E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

### **3.11 SEISMIC RESTRAINTS**

- A. All equipment, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.
- B. Piping shall be braced as follows:
  - 1. Brace all gas piping that is 1" nominal diameter and larger.
  - 2. Brace all piping located in mechanical equipment rooms that is 1 1/4" nominal diameter and larger.
  - 3. Brace all piping that is 2 1/2" nominal diameter and larger.
  - 4. Transverse bracings at 40'-0" on center maximum (minimum of one brace per direction of run).
  - 5. Longitudinal bracings at 80'-0" on center maximum (minimum of one brace per direction of run).
  - 6. Transverse bracing shall be 20'-0" on center maximum and longitudinal bracing at 40'-0" on center maximum for gas piping and piping in mechanical rooms.
  - 7. Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24" of the elbow or tee and is connected to the largest pipe.
  - 8. Do not use branch lines to brace main lines.
  - 9. Provide flexibility in joints where pipes pass through building seismic or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators.
  - 10. At vertical pipe risers, support the weight of the riser at a point or points above the center of gravity of the riser wherever possible. Provide lateral guides at the top and bottom of the riser and at intermediate points not to exceed 30'-0" on center.
  - 11. No bracing is required if the top of single pipe is suspended 12" or less from the connection point at the supporting structural member.

### **3.12 MANUFACTURER'S DIRECTIONS**

- A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.
- B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.
- C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

### **3.13 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS**

- A. Do not install piping, equipment, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

- B. Do not install piping or equipment within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

### **3.14 CATHODIC PROTECTION**

- A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

### **3.15 PIPING AND EQUIPMENT IDENTIFICATION**

- A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.
- B. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.
- C. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

### **3.16 GUARANTEE**

- A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.
- B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

### **3.17 TESTING**

- A. Test all equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

### **3.18 OPENINGS**

- A. Locating and sizing of all openings for piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

### **3.19 CLEAN-UP**

- A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean, and in a condition acceptable to the Architect.
- B. Clean all work installed under this Contract to satisfaction of Owner.

### **3.20 OPERATING INSTRUCTIONS AND OPERATOR TRAINING**

- A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.
- B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.
- C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

### **3.21 OPERATING AND MAINTENANCE MANUALS**

- A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.
- B. Provide the following equipment and maintenance information where applicable:
  - 1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.
  - 2. Identifying equipment manufacturer, product name, and model number.
  - 3. Locations.
  - 4. Wiring Diagrams.
  - 5. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
  - 6. Assembly and disassembly instructions.
  - 7. Startup procedures.
  - 8. Routine and normal operating instructions.
  - 9. Normal and emergency shutdown instructions.
  - 10. Troubleshooting diagnostic instructions.
  - 11. Parts list and recommended spare parts including name and address of source of supply.
- C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.



- D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.
- E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

**END OF SECTION**

## **SECTION 22 05 00**

### **PLUMBING**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 22 Sections apply to this Section.

##### **1.2 SCOPE OF WORK**

- A. Provide labor, materials, equipment, and services to furnish and install complete plumbing and piping systems which shall include, but not limited to fixtures, equipment, piping, valves, and supports.

##### **1.3 SUBMITTALS**

- A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:
  - 1. Gas Pressure Regulators.
  - 2. Piping and fittings.
  - 3. Insulation.
  - 4. Pipe hangers and supports.
  - 5. Valves.
- B. No substitute materials or equipment shall be installed without the written approval of the Architect.
- C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.
- D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

##### **1.4 QUALITY ASSURANCE**

- A. Each length of pipe, fitting, trap, fixture, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer's name or mark.

##### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor's expense.
- B. Handling flammable liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

- C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- D. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

## **PART 2 – PRODUCTS**

### **2.1 GAS PIPING AND FITTING MATERIALS**

- A. Above Grade Interior Piping: ASTM A53B seamless, Schedule 40, carbon steel pipe.
- B. Above Grade Exterior Piping: ASTM A53B seamless, Schedule 40, carbon steel pipe, hot dipped and galvanized coating.
- C. Above Grade Fittings: 150# black malleable iron fittings and threaded joints for pipes 2" and smaller, butt welded joints for pipes 2 1/2" and larger. Hot dipped and galvanized coating for exterior fittings.
- D. Press fittings shall be permitted for use where approved by local authorities having jurisdiction and in compliance with current codes.
- E. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
- F. Gas Cocks: For high pressure gas service use Dezurik Series 400 lubricated gas cock with RS49 or RS51 plug seals, UL listed. On low pressure service lines use Milwaukee BB2 100 Butterball, NIBCO, or approved equal.

### **2.2 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves shall be UL listed for Natural Gas.
- B. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
- C. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
  - 3. Cast-iron, non-lubricated plug valve.

### **2.3 WATER PIPING AND FITTING MATERIALS**

- A. All water piping shall comply with NSF/ANSI Standard 372 for low lead requirements.
- B. Above Grade: ASTM B88, Type L copper tubing, hard temper with wrought copper fittings.
- C. Joints: 1/2" to 1-1/2" pipe sizes soldered using ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813. 100 percent lead free, 95 percent tin and 5 percent antimony composition, silver bearing solders unless otherwise indicated.

- D. Joints: 2" and larger pipe sizes brazed using AWS A5.8/A5.8M, AWS BCuP Series copper-phosphorous alloys.
- E. Insulation: Insulate outdoor piping with 1" Glass Fiber Insulation and 0.016 aluminum jacket.

## **2.4 HOT WATER PIPING INSULATION**

- A. Acceptable manufacturers: Johns Manville, Owens Corning, Knauf.
- B. Glass Fiber: Conforming to ASTM C547, rigid molded, non-combustible.
  - 1. Installed thermal conductivity: 0.23 btu-inch per hour-ft<sup>2</sup>-°F at 75°F.
  - 2. 1" thickness.
  - 3. Owens-Corning SSLII with ASJ max or other equal.
- C. All insulated piping installed indoors shall be protected with PVC jacketing.
- D. All insulated piping installed outdoors or in exposed locations shall be in protected with 0.016 inch thick aluminum jacketing.
- E. All insulation shall in accordance to California Energy Code.

## **2.5 WATER PIPING VALVES**

- A. All valves shall be the product of a single manufacturer. Milwaukee, NIBCO, Stockham, Crane, or approved equal. 125 PSIG steam service rated and 300 PSIG air and water rated. All valves shall be low lead type per NSF/ANSI Standard 372.
- B. Provide valves with screwed or flanged ends as required by the piping system in which they are installed.
- C. Shut-off valves 2 inches and smaller: Ball Valve. Bronze body, two piece, full port, extended handle that allows operation of valve without disturbing the insulation.
- D. Shut-off valves 2 1/2 inches and larger: Gate Valve. Iron body, resilient wedge, outside screw and yoke.
- E. Check valves: Bronze body, swing check, screwed. Provide non-slam check on pumped equipment or quick closing fixtures.
- F. Relief valves: Bronze body, spring and diaphragm combination pressure and temperature relief valves with test lever and automatically resetting type thermostatic element. Tested under ANSI Z21.22 and rated relief capacities greater than water heater's input rating.

## **2.6 CONDENSATE DRAIN PIPING**

- A. Condensate drain piping shall be type DWV copper with wrought copper fittings.
- B. Condensate drain piping inside building shall be insulated with 1" thick closed cell elastomeric foam insulation. Armaflex, Aeroflex, or approved equal.

## 2.7 UNIONS AND FLANGES

- A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, or vent piping. Dielectric unions installed in potable water systems shall conform to lead free requirements.
- B. Install unions in piping 2" and smaller and flanges in piping 2 1/2" and larger at each connection to all equipment, tanks, and automatic valves.
- C. Locate unions for easy removal of equipment, tank, or valve.

## 2.8 PIPE HANGERS AND SUPPORTS

- A. Provide adequate supports, hangers, guides, thrusters, etc. as necessary to allow for proper movement of the piping at the building seismic joints and at the thermal expansion loops and flexible connectors, taking into account the pipe size, flex connection type, required seismic movement and system operating temperature and pressure.
- B. Acceptable manufacturers: B-line, Tolco, Superstrut, Unistrut, or approved equal.
- C. Plumbers tape or sheetmetal straps shall not be used for hanging or supporting of pipes.
- D. Support horizontal piping in accordance with the following schedule:

| Pipe Size<br>(inches) | Maximum Hanger Spacing (feet) |              |        |         |     |      | Hanger Rod Diameter<br>(inches) |        |         |
|-----------------------|-------------------------------|--------------|--------|---------|-----|------|---------------------------------|--------|---------|
|                       | Steel                         | Cast<br>Iron | Copper | Plastic |     |      | Steel /<br>Cast<br>Iron         | Copper | Plastic |
|                       |                               |              |        | CPVC    | PVC | PP   |                                 |        |         |
| upto 1                | 7                             | -            | 5      | 3.5     | 3   | 2.75 | 3/8                             | 3/8    | 3/8     |
| 1 1/4                 | 9                             | -            | 7      | 3.5     | 3   | 2.75 | 3/8                             | 3/8    | 3/8     |
| 1 1/2 & 2             | 9                             | 5            | 8      | 3.5     | 3.5 | 2.75 | 3/8                             | 3/8    | 3/8     |
| 2 1/2                 | 12                            | 5            | 9      | 3.5     | 3.5 | 3.5  | 1/2                             | 1/2    | 1/2     |
| 3                     | 12                            | 5            | 10     | 3.5     | 3.5 | 3.5  | 1/2                             | 1/2    | 1/2     |
| 3 1/2                 | -                             | 5            | 11     | -       | -   | -    | 5/8                             | 1/2    | -       |
| 4                     | 12                            | 5            | 12     | 4       | 4   | 4    | 5/8                             | 5/8    | 5/8     |
| 5                     | 12                            | 5            | 13     | 4       | 4   | 4    | 5/8                             | 5/8    | 5/8     |
| 6                     | 12                            | 5            | 14     | 4       | 4   | 4    | 3/4                             | 3/4    | 3/4     |
| 8 to 12               | 12                            | 5            | 14     | 4       | 4   | 4    | 7/8                             | 3/4    | 7/8     |

- E. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.
- F. Support piping on the roof in accordance with the following schedule:

| Nominal Pipe Size<br>(inches) | Spacing of Supports<br>(feet) |
|-------------------------------|-------------------------------|
| 1/2                           | 6                             |
| 3/4 or 1                      | 8                             |

|                            |                   |
|----------------------------|-------------------|
| 1 1/4 or larger            | 10                |
| 1 1/4 or larger (Vertical) | Every floor level |

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural gas piping according to NFPA 54 to determine that natural gas utilization devices are turned off in piping section affected.

### **3.2 PIPE SIZES TO EQUIPMENT**

- A. Pipe sizes indicated, including required valving, shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within 1'-0" of equipment.

### **3.3 PIPING GENERAL INSTALLATION**

- A. Thoroughly clean all pipe and maintain in clean condition during construction temporarily capping or plugging ends of pipe when not being worked on.
- B. Cut pipes accurately to measurements established at the site and work into place without springing or undue forcing and out of the way of openings, ductwork, and equipment; ream ends of screwed pipes and tubing to original bore before connecting together.
- C. Protect all piping located over switchboards, electrical machinery, or equipment against condensation. Insulate piping and install sheetmetal pan underneath piping running above electrical equipment and panels.
- D. Where changes in pipe size occur, use only reducing fittings.
- E. Provide screwed unions or flanges in locations required for disconnecting and connecting of all equipment.
- F. Pipe runs in masonry and concrete floors shall be sleeved for protection.
- G. Chase or sleeve all lines rising in footings and where running concealed through walls.
- H. Caulk space between pipes and sleeves in exterior walls and in concrete slabs with graphite packing and waterproof plastic compound; caulk with Dow Corning #3 6548 Silicone RTV Foam per manufacturer's recommendations at fire walls.
- I. Place escutcheons, stamped with #16 gauge steel and chromium plated, on pipes passing through sleeves in walls, floors or ceiling where exposed to view within a finished area. Grout in all other lines.
- J. Support piping where necessary at sufficiently close intervals (and 24" from each fitting and change of direction) to keep it in alignment and to prevent sagging.
- K. Anchor vertical risers with hooks, brackets, or clamps to make rigid.

- L. All changes of direction of piping shall be made with fittings. Do not bend pipe.
- M. Flash roof vent piping through roof with 24 gauge or heavier galvanized flashing. Make watertight with black fibrous mastic. Extend flashing into roofing felt 12" from pipes.
- N. Insulate cold water piping outdoors for freeze protection.

### **3.4 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints:
  - 1. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints:
  - 1. Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

### **3.5 GAS PIPING INSTALLATION**

- A. Arrange with Owner and PG&E before turning meter off for tie-in for new installation in location shown.
- B. Make necessary connections to supply service to equipment as shown. Make installation in accordance with requirements of governing codes and the National Fire Protection Association.
- C. Provide building gas shut-off valve in accessible location outside each building. Provide sign affixed to wall at valve location reading: "Gas Shut-Off." Size and location of the sign shall be as required by the Authority Having Jurisdiction. minimum 1/4" size lettering.

- D. Cut pipe accurately to measurements established at building; work into place without springing or forcing; and clear all windows, doors, and other openings. Cutting or other weakening of building structure to facilitate piping installation not permitted.
- E. Ream all piping to remove burrs and install to permit free expansion and contraction without damage.
- F. Make all changes in direction with fittings and changes in main sizes through eccentric reducing fittings with top of pipe flat.
- G. Piping at furnaces, etc. supported independently so pipe weight is not supported by equipment.
- H. Provide the following:
  - 1. Swing joints or run-outs to equipment with swing connections, expansion loops, and/or devices at all other points for flexible piping system.
  - 2. Shut-off valves, balancing valves, and unions or flanges at each branch and in supply and return to each item of equipment. Valves and unions or flanges suitably located to isolate each unit; branch circuit or section of piping to facilitate maintenance and removal of all equipment and apparatus.
  - 3. Caps or plugs for all open ends of pipe and equipment during installation to keep out dirt and other foreign matter.
  - 4. Necessary temporary connections, valves, oversize flushing connections, pumps, etc. as required to properly clean and test system.

### **3.6 CONDENSATE DRAIN PIPING INSTALLATION**

- A. Lay piping in straight lines at a minimum slope of 2 percent in direction of flow of drainage system, unless otherwise noted on the Drawings.
- B. Keep stopper in mouth of pipe when pipe laying is not in process.
- C. Make changes in direction with long sweep or bends. Do not change direction of flow more than 90 degrees.
- D. Reducing size of drainage piping in direction of flow is prohibited.
- E. Install traps where required by code regulations.
- F. Install cleanouts at ends of horizontal runs.
- G. Makeup cleanout plugs with graphite and oil to facilitate easy removal.
- H. Deliver to the owner at completion of work two (2) suitable wrenches for each type of cleanout installed.

### **3.7 WATER PIPING INSTALLATION**

- A. Extend piping for hot and cold water, including mains, risers, and supplies to fixtures and indicated equipment. Carry headers for groups of fixtures full size throughout their length.



- B. All domestic water piping shall be arranged to drain to low points and to provide for air elimination at high points.
- C. All ferrous to non-ferrous pipe connections shall be made with accepted dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.
- D. Insulate all domestic hot and hot water return piping and fittings.
- E. Make changes in pipe sizes with reducing tees or reducer fittings.
- F. Install a shut off valve at domestic water line to each fixture group so that each group can be shut off without shutting down the other parts of the system.
- G. Provide shut off valves for all plumbing equipment, fixtures, and fixture trim which do not have supply stop or integral isolation valves included.
- H. Arrange and orientate valves, trap primers, water hammer arrestors, etc. in manner accessible for maintenance and/or removal.
- I. No water piping will be permitted below slab on grade unless shown on Drawings.
- J. Contractor to inquire from Owner the time to make tie-in to existing systems.

### **3.8 HANGER AND SUPPORT INSTALLATION**

- A. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- C. Install lateral bracing with pipe hangers and supports to prevent swaying.
- D. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.
- F. Adjust hangers to distribute loads equally on attachments.
- G. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

### **3.9 PAINTING**

- A. Paint exposed, exterior metal piping, valves, service regulators, valves, and piping specialties, except components with factory-applied paint or protective coating.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
- C. Refer to Division 09 for additional painting requirements.

### **3.10 TESTING, ADJUSTING, AND CLEANING**

- A. Provide testing of all installed gas, domestic water, drainage and vent systems during progress of work. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed.
- B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.
- C. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.
- D. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.
- E. Gas Piping: All gas piping shall be tested per NFPA 54 to 60 psig for 1 hour without drop in pressure. Equipment and personnel shall be protected from this test procedure. Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System shall not be approved until it can be demonstrated that there is no measurable loss of test pressure during test period.
- F. Water Piping: All water piping shall be tested to 100 psig with potable water and held for 8 hours without drop in pressure before it is covered and concealed. Equipment and personnel shall be protected from this test pressure. After fixtures are connected, test system for 2 hours at 75 psig or prevailing water pressure, whichever is higher.
- G. Upon completion of work, clean all equipment and piping installed under this Section.

### **3.11 DISINFECTION**

- A. Upon completion of all tests and necessary replacements, all domestic water piping shall be disinfected. Chlorination shall be accomplished by personnel in direct employ of a firm licensed to do this type of work. After work has been accomplished, provide the Owner and Architect with a statement from the laboratory indicating the water is suitable for human consumption.
- B. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute.
- C. Comply with local requirements where local code requirements are more stringent. Provide necessary labor, equipment, material, and test kits for chlorine application and tests. Make all arrangements with jurisdictional water authority for witnessing chlorination tests and tests of proper disinfection.
- D. Sterilize all parts of building water system with water solution containing 50 ppm of available chlorine for at least a 24 hour contact period. After contact period, flush all parts of system with clear water until system tests at no more than 0.2 ppm residual chlorine.

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- E. Flush thoroughly and submit bacteriological samples to a certified laboratory which shall certify in writing that the water is suitable for drinking.

### **3.12 TRAINING AND O&MS**

- A. Refer to Section 22 00 00 Plumbing General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

**END OF SECTION**

## **SECTION 23 00 00**

### **MECHANICAL GENERAL REQUIREMENTS**

#### **PART 1 – GENERAL**

##### **1.1 CONDITIONS AND REQUIREMENTS**

- A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

##### **1.2 SCOPE OF WORK**

- A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.
- B. Consult all other Sections to determine the extent of this work specified elsewhere.
- C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

##### **1.3 REGULATIONS AND STANDARDS**

- A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:
  - 1. California Building Code
  - 2. California Electrical Code
  - 3. California Plumbing Code
  - 4. California Mechanical Code
  - 5. California Energy Code
  - 6. California Green Buildings Standard
  - 7. California Fire Code
  - 8. National Fire Protection Association

##### **1.4 QUALITY ASSURANCE**

- A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner's insurance underwriter.
- B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.
- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

- D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

#### **1.5 SAFETY**

- A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities within Contractor's scope of work.

#### **1.6 PERMITS, FEES, AND UTILITIES**

- A. Secure and pay for all permits, licenses, inspections, and fees required.
- B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

#### **1.7 PAINTING**

- A. See Division 09 for painting.

#### **1.8 COORDINATION**

- A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.
- B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.
- C. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.
- D. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

- E. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.
- F. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

## **PART 2 – PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS**

- B. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.
- C. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.
- D. Furnish all materials and equipment of the same type by the same manufacturer.
- E. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.

### **2.2 ALTERNATE EQUIPMENT AND MATERIALS**

- A. No substitute materials or equipment may be installed without the written approval of the Architect.
- B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.
- C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.
- D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

### **2.3 SUBMITTALS**

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

- C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.
- D. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.
- E. Submittals will be returned to indicate appropriate action taken as follows:
  - 1. No Exceptions Taken.
  - 2. Make Corrections Noted. No Resubmittal Required.
  - 3. Revise and Resubmit.
  - 4. Rejected.
  - 5. Not Reviewed.
- F. Use electronic form acceptable to Architect for electronic submittals, containing the following information:
  - 1. Project name.
  - 2. Date.
  - 3. Name and address of Architect and Engineer.
  - 4. Name of Owner.
  - 5. Name, address and contact information of Contractor.
  - 6. Names and contact information of sub-contractor, manufacturer, and supplier.
  - 7. Name of entity that prepared submittal.
  - 8. Category and type of submittal.
  - 9. Specification Section number and title.
  - 10. Drawing number and detail references, as appropriate.
  - 11. Transmittal number, numbered consecutively and revision number clearly identified.
  - 12. Each item submitted labeled or identified the same as on the drawings.
- G. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.
- H. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.
- I. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.
- J. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION OF SITE**

- A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

### **3.2 DRAWINGS**

- A. Drawings show general arrangement and location of ductwork, piping, and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of ducts and piping. Field verify all dimensions.
- B. The exact locations of equipment, ducts, piping, and registers shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of ducts, registers, piping, and equipment up to the time of installation without additional cost.
- C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.
- D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

### **3.3 RECORD DRAWINGS**

- A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.
- B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.
- C. Record drawings must include the following as a minimum:
  - 1. Actual equipment locations.
  - 2. Revisions or substitutions to equipment schedules.
  - 3. Duct/pipe size and routing.
  - 4. Dimensional changes to drawings.
  - 5. Revisions to details shown on drawings.



6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.
9. Controls sequence of operations.

### **3.4 PROTECTION OF BUILDING**

- A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

### **3.5 DELIVERY, DRAYAGE AND HAULING**

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.
- B. Provide proper protection and storage of all items and tools required.
- C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

### **3.6 EQUIPMENT AND MATERIAL PROTECTION**

- A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.
- C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.
- D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.
- E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

### **3.7 QUALITY OF WORK**

- A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.
- B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

### **3.8 CUTTING AND PATCHING**

- A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.
- B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping, or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.
- D. Provide sleeves for all ductwork and piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and ductwork or piping. When ductwork or piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

### **3.9 ACCESS**

- A. Damper operators, filters, and indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.
- B. No dampers, controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.
- C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.
- D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.
- E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

### **3.10 SEISMIC RESTRAINTS**

- A. All equipment, ductwork, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.

### **3.11 MANUFACTURER'S DIRECTIONS**

- A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.
- B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.
- C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

### **3.12 BELT DRIVES**

- A. Belt drives for fans and equipment shall consist of "V" belts and sheaves.
- B. Drives that require not more than two belts shall be provided with variable pitch, driving sheaves to provide some speed adjustment above and below the normal required operating speed; the adjustments to be as near equal as practicable.
- C. Belts shall be furnished in matching sets.
- D. Fan drives for blower-type fans shall be selected for the proper fan speeds required for the air volumes specified or shown on the Drawings at the static pressures indicated. The static pressures indicated show estimated conditions, which may vary under actual operating conditions. Should it be necessary to adjust the fan speeds to obtain the proper air volume, the Contractor shall make the necessary changes to the drives without additional cost the Owner.

### **3.13 ELECTRICAL MOTORS FOR HVAC EQUIPMENT**

- A. Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified equipment.
- B. Motors and motor control equipment shall conform to NEMA standards and shall be UL listed.
- C. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the in-rush current characteristics of the motor with the motor starter selection, so that all items furnished constitute a complete motor control and protection package. Motor shall not operate in the 15% service factor range.
- D. Motors located in ducted air streams or subject to outside air elements shall be totally enclosed fan cooled; others shall be open drip-proof design.
- E. Motors used with variable frequency drives shall be designed specifically for use on AC inverter power and adjustable speed applications.
- F. Each motor shall be factory-wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point of field power connection under Division 26.
- G. Motors 1/2 HP and smaller shall be rated 120 VAC – single phase – 60 hertz and shall be provided with integral thermal overload protection, unless otherwise indicated.

- H. Motors 3/4 HP and larger shall be rated for 208 VAC or 460 VAC – 3 phase – 60 hertz, unless otherwise indicated.

### **3.14 COORDINATION WITH ELECTRICAL CONTRACTOR**

- A. Coordinate with the Electrical Contractor on furnishing and installing of controls, motors, starters, etc. Provide copies of submittal and installation data to Electrical Contractor for all items requiring electrical connection.
- B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in Division 26.
- C. Electrical Contractor shall furnish disconnect switches, motor starters, conduit and wiring for line voltage power to the equipment. See Division 26 and Drawings.

### **3.15 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS**

- A. Do not install piping, equipment, or ductwork, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.
- B. Do not install piping, equipment, or ductwork within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

### **3.16 LUBRICATION**

- A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.
- B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

### **3.17 EQUIPMENT GUARDS**

- A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts or machinery. Provide access openings for greasing, oiling, adjusting, etc. All guards shall comply with OSHA requirements and applicable codes.

### **3.18 CATHODIC PROTECTION**

- A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

### **3.19 EQUIPMENT IDENTIFICATION**

- A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, motor starters, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.
- B. Label each thermostat and switch with equipment connected to the thermostat or switch with black lettering on white background.

### **3.20 GUARANTEE**

- A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.
- B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

### **3.21 TESTING**

- A. Test all ductwork, equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

### **3.22 OPENINGS**

- A. Locating and sizing of all openings for ductwork and piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

### **3.23 CLEAN-UP**

- A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean and in a condition acceptable to the Architect.
- B. Clean all work installed under this Contract to satisfaction of Owner.
- C. Remove debris and trash from ductwork, fan units, and all air handling equipment. Vacuum clean fan housing, coils, and ducts in vicinity of openings before grilles and registers are installed. Replace construction filters with new filters prior to project completion.

### **3.24 ACCEPTANCE TESTING**

- A. Equipment and systems requiring acceptance testing certification for Code Compliance shall have Certificate of Acceptance completed and submitted to enforcement agency. See Drawings for equipment and systems requiring acceptance certification. Tests shall be performed by Certified Mechanical Acceptance Test Technician. Contractor shall be responsible for procuring the required test forms from the California Energy Commission website.

**3.25 OPERATING INSTRUCTIONS AND OPERATOR TRAINING**

- A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.
- B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.
- C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

**3.26 OPERATING AND MAINTENANCE MANUALS**

- A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.
- B. Provide the following equipment and maintenance information where applicable:
  - 1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.
  - 2. Identifying equipment manufacturer, product name, and model number.
  - 3. Locations.
  - 4. Wiring Diagrams.
  - 5. Lubrication Charts.
  - 6. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
  - 7. Assembly and disassembly instructions.
  - 8. Startup procedures.
  - 9. Routine and normal operating instructions.
  - 10. Normal and emergency shutdown instructions.
  - 11. Troubleshooting diagnostic instructions.
  - 12. Parts list and recommended spare parts including name and address of source of supply.
- C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.
- D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.
- E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

Boiler Replacement at  
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**END OF SECTION**

## **SECTION 23 01 30**

### **CLEANING OF EXISTING HVAC AIR DISTRIBUTION**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and Division 23 Specification Sections, apply to this Section.

##### **1.2 WORK INCLUDED**

- A. Cleaning existing HVAC air distribution equipment, ducts, registers, grilles, plenums, and system components.
- B. Clean entire supply, return, and exhaust air system from the points where the air enters the system the points where air is discharged from the system. Ducts, turning vanes, diffusers, and grilles are all considered part of the system.

##### **1.3 DEFINITIONS**

- A. ASCS: Air Systems Cleaning Specialist.
- B. NADCA: National Air Duct Cleaners Association.
- C. MSDS: Material Safety Data Sheets.
- D. OSHA: Occupational Safety and Health Administration.

##### **1.4 QUALITY ASSURANCE**

- A. Membership: Contractor shall be a certified member of NADCA, or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- B. Certification: The Contractor shall have a minimum of one (1) ASCS certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- C. Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization shall be responsible for the total work herein specified.
- D. Experience: The Contractor shall submit records of experience in the field of HVAC system cleaning. Bids shall only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.
- E. Equipment, Materials and Labor: The Contractor shall possess and furnish all necessary equipment, materials, and labor to adequately perform the specified services.



- F. The Contractor shall always maintain a copy of all current MSDS documentation and safety certifications at the site, as well as comply with all other site documentation requirements of applicable OSHA programs.
- G. The Contractor shall comply with all federal, state, and local rules, regulations, and licensing requirements.
- H. The Contractor shall assure its employees have received safety equipment training, personal protective equipment, MSDS as required for the work.

## **1.5 DRAWINGS**

- A. The contractor shall be responsible to verify accuracy of as-built drawings. No additional costs shall be allowed due to inaccuracies in the provided drawings.

## **1.6 STANDARDS**

- A. All work shall be performed in accordance with the current publish NADCA ACR standard; Assessment, Cleaning, and Restoration of HVAC systems.

## **1.7 SUBMITTALS**

- A. Within 30 days of Contractor's Notice to Proceed, submit the following documents:
  - 1. Qualifications.
  - 2. Strategies and procedures plan.
  - 3. Proposed equipment and data sheets.
- B. Submit final, post-project report including cleanliness verification, evaluations, and recommendations.

## **PART 2 – PRODUCTS (NOT USED)**

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Conduct a site evaluation to establish a specific, coordinated plan which details duct cleaning by room numbers, where duct cleaning equipment will be staged, and how each area of the building will be protected during the various phases of the project.
- B. Inspect HVAC air distribution equipment, ducts, registers, grilles, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the work.
- C. Prepare a written plan for air distribution system cleaning that documents existing conditions of the system. Include documentation of existing conditions including inspection results, photo images, and laboratory results.
- D. Proceed with work only after conditions detrimental to performance of the work have been corrected. Damaged systems shall be brought to the attention of the Architect.

- E. Mark the position of manual volume dampers and air directional mechanical devices inside the system prior to cleaning.
- F. Use existing service openings as required for proper cleaning and inspection.

### **3.2 GENERAL CLEANING PROCEDURE**

- A. Comply with NADCA ACR including items identified as “recommended,” “advised,” and “suggested.”
- B. Perform electrical lockout and tagout according to Owner’s standards or authorities having jurisdiction.
- C. Remove non-adhered substances and deposits from within the HVAC system. Debris removed during the cleaning shall be collected and precautions must be taken to ensure the debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- D. Use all means necessary to protect all existing equipment, premises, and materials before, during, and after cleaning. This includes providing any polyethylene sheeting or equivalent to cover existing classroom and office equipment.
- E. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into building. Where particulate collection equipment is exhausting inside building, HEPA filtration with 99.97% collection efficiency for particles sized 0.3 micrometer or larger shall be used.
- F. Control odors and mist vapors during the cleaning and restoration process.
- G. Mark the position of manual volume dampers and air directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
- H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
- I. Clean all air distribution devices, registers, grilles, and diffusers.
- J. Mechanically clean all duct systems to remove all visible contaminants such that the systems are capable of passing Clean Verification Tests (see NADCA Standards).
- K. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
- L. Service openings: utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and inspection.
  - 1. Utilize existing service openings already installed in the HVAC system where possible.
  - 2. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.
  - 3. Openings must not compromise the structural integrity of the system.
  - 4. Construction techniques used in creation of openings should conform to requirements of applicable building and fire codes.

5. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
6. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the Architect in project report documents.

### **3.3 HEALTH AND SAFETY**

- A. Comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment.
- B. Comply with CAL-OSHA requirements regarding fan motor disconnect lock/tag out procedures and confined space entry regulations.
- C. No process or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- D. All debris removed from the HVAC system shall be disposed of in accordance with applicable federal, state, and local requirements.

### **3.4 MECHANICAL CLEANING METHODOLOGY**

- A. Source Removal Cleaning Methods: The HVAC system shall be cleaned using source removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system. It is the contractor's responsibility to select source removal methods that will render the HVAC system visibly clean and capable of passing cleaning verification methods.
  1. Use continuously operating vacuum collection devices to keep each section being cleaned under negative pressure.
  2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters.
  3. All vacuum devices exhausting air outside the facility shall be equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system.
  4. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.
- B. Cleaning Mineral Fiber Insulation Components:
  1. Fibrous glass thermal or acoustical insulation elements present in the equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to wet according to NADCA ACR.
  2. Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing the HVAC system cleanliness tests (see NADCA ACR).

3. Fibrous materials that become wet shall be discarded and replaced.
- C. Damaged Fibrous Glass Material
1. Evidence of damage: if there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
  2. Replacement: when requested or specified, contractor shall inform mechanical contractor to replace damaged insulation.
- D. Application of Antimicrobial Treatment:
1. Biocides to treat fungal and bacterial growth shall not be used without prior authorization from the Architect.
  2. Biocidal agents shall only be applied if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified through testing.
  3. Application of any biocidal agents used to control growth of fungal or bacteriological contaminants shall be performed after the system is rendered clean.
  4. When used, chemical biocides and coatings shall be applied in strict accordance with manufacturer recommendations and EPA registration listing.
  5. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces.

### **3.5 CLEANLINESS VERIFICATION**

- A. Verify cleanliness according to NADCA ACR, "Verification of HVAC System Cleanliness" section.
- B. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment related substances to the HVAC system, including biocidal agents and coatings.
- C. The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the Owner reserves the right to further verify system cleanliness through surface comparison testing or NADCA vacuum test.
  2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
  3. NADCA vacuum test analysis shall be performed by a qualified third party experienced in testing of this nature. Testing agency shall submit evidence of performing this type of work for a minimum of 2 projects within the last 36 months.
  4. Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

### **3.6 RESTORATION**

- A. Restore and repair HVAC air distribution, equipment, ducts, plenums, and components according to NADCA ACR, "Restoration and Repair of Mechanical Systems" section.
- B. Restore service openings capable of future reopening.
- C. Reseal fibrous glass ducts.
- D. Replace fibrous glass materials that cannot be restored by cleaning or resurfacing.
- E. Replace damaged insulation.
- F. Ensure that closures do not hinder or alter airflow.
- G. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.
- H. Restore manual volume dampers and air directional mechanical devices inside the system to their marked position on completion of cleaning.

### **3.7 PROJECT CLOSEOUT**

- A. At the conclusion of the project, the Contractor shall provide a report to the Architect indicating the following:
  - 1. Post cleaning laboratory results if any.
  - 2. Post cleaning photo images.
  - 3. Post cleaning verification summary.
  - 4. As-built drawings showing any deviations from Owner's record drawings and locations of service openings.

**END OF SECTION**

## **SECTION 23 05 00**

### **HEATING, VENTILATING, AIR CONDITIONING**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 23 Sections apply to this Section.

##### **1.2 SCOPE OF WORK**

- A. Provide labor, materials, equipment, and services to furnish and install complete mechanical systems which shall include, but not limited to equipment, ductwork, piping, accessories, insulation, and supports.

##### **1.3 SUBMITTALS**

- A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:
  - 1. Packaged Air Conditioners.
  - 2. DOAS Units.
  - 3. Split Systems.
  - 4. VRF Heat Pump and Fan Coils.
  - 5. Fans.
  - 6. Ductwork.
  - 7. Duct Insulation and Lining.
  - 8. Dampers and Duct Accessories.
  - 9. Filters.
  - 10. Diffusers, Registers, and Grilles.
  - 11. Refrigerant Piping.
  - 12. Mechanical Supports.
  - 13. Controls.
- B. No substitute materials or equipment shall be installed without the written approval of the Architect.
- C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.
- D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

## **PART 2 – PRODUCTS**

### **2.1 HVAC EQUIPMENT**

- A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

### **2.2 FILTERS**

- A. Filters shall be 2"-thick of size and number required for equipment and selected for 300 FPM velocity.
- B. Filters shall be throwaway type, Class 2 UL listed.
- C. Filters shall be minimum MERV 13 based on ASHRAE Standard 52.2 test method.

### **2.3 DUCTWORK**

- A. Comply with latest edition of SMACNA HVAC Duct Construction Standards, Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Comply with NFPA 90A when ducts traverse through smoke zones.
- B. Comply with UL 181 and California Energy Code Section 120.4 requirements for air distribution ducts and plenums.
- C. Ducts shall be minimum 24 gauge thickness. Ducts shall be constructed for 2500 FPM maximum velocity and static pressure classes as follows:
  - 1. Supply Ducts: +3 inch w.g.
  - 2. Return Ducts: - 2 inch w.g.
  - 3. Exhaust Ducts: -2 inch w.g.
- D. Longitudinal seams: Groove and Pittsburgh lock seams and slip joints shall be used.
- E. Duct Connections: Ductmate industries "Ductmate 35" and "Ductmate 45". Ductmate "Spiralmate" for round duct. Ductmate "Ovalmate" for oval duct.
- F. Duct sealing shall be DP 1010 water based duct sealant and SMACNA approved foil-backed pressure sensitive tape or Hardcast, Two Part II Duct Sealing System: DT-5400 tape with RTA-50 sealant.
- G. Flexible ducts shall be UL 181 and Class I air duct in compliance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, and NFPA 90A and 90B.
- H. Flexible ducts shall be two-ply vinyl film supported by helically wound spring-steel wire, R4.2 fiberglass insulation, exterior reinforced laminated vapor barrier film. Duct shall be rated for +2 inch w.g., -1 inch w.g., 4000 FPM maximum velocity, and -10°F to +160°F. Flame Spread less than 25, Smoke Developed less than 50.

### **2.4 DUCT INSULATION AND LINING**

- A. All duct insulation and lining shall comply with California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

- B. Insulation shall conform to NFPA 90A and 90B, and UL 181, Class I. Insulation shall have Flame Spread not over 25 and Smoke Developed of not over 50.
- C. Wherever external duct insulation is specified and internal acoustic treatment of equivalent insulating effect is also required by the Drawings or Specification for the same location, the external insulation may be omitted.
- D. Acceptable Manufacturers: Johns Manville, Owens Corning or approved equal.
- E. Acoustic Duct Liner: 1" thick, R4.2 in directly conditioned space and 2" thick, R8.0 in unconditioned space or outdoors. Owens Corning Quiet R, or approved equal.
- F. Duct Insulation: 3" thick, R8.3 in unconditioned space and 1 1/2" thick, R4.2 for indirectly conditioned space. Owens Corning SoftR Ductwrap FRK, or approved equal.
- G. Duct Insulation Outdoor: 2" thick rigid board fiberglass, R8.7 with 0.016 inch thick sheet Aluminum jacket.

## **2.5 REGISTERS, DIFFUSERS AND GRILLES**

- A. Acceptable manufacturers: Titus, Krueger.
- B. Registers, diffusers, and grilles shall be as indicated on Drawings. Drawings and schedules indicate specific requirements of air inlets and air outlets. Other manufacturers' products with equal quality, appearance, finish, and performance characteristics may be considered.
- C. Registers shall have adjustable air pattern for setting in field to match field conditions. Redirect air pattern when required.
- D. Refer to Architectural Drawings and Specifications for reflected ceiling plans, elevations, wall and ceiling type and construction. Coordinate frame and border types to accommodate the wall or ceiling specified or shown on the Architectural Drawings.
- E. Registers, diffusers, and grilles in fire-rated ceilings or walls shall be all-steel construction.

## **2.6 DAMPERS AND DUCT ACCESSORIES**

- A. Acceptable manufacturers:
  - 1. Dampers: Ruskin, Air Balance Inc, Pottorff, or approved equal.
  - 2. Actuators: Belimo, Honweywell, or approved equal.
  - 3. Turning vanes: Ductmate industries, Duro Dyne, or approved equal.
  - 4. Flexible connectors: Duro Dyne, Ventafabrics, or approved equal.
  - 5. Duct access doors: Ductmate industries, Ward industries, or approved equal.
  - 6. Backdraft dampers: Ruskin, Greenheck, Air Balance Inc, or approved equal.
  - 7. Fire dampers: C&S Air Products, or approved equal.
- B. Provide volume dampers as specified or shown on the Drawings for proper balancing and distribution of air. Provide single blade dampers in ducts 24 inches in width or less, or 12 inches in height or less. Provide multiple blade, opposed blade design, dampers for all other duct sizes. Coordinate with the balancing contractor and provide additional dampers required for proper air balance.



- C. Dampers shall be galvanized steel construction and shall be minimum 2 gauges thicker than duct gauge. Damper shall be pivoted to turn easily, provided with operating handles and locking devices mounted on the outside of the duct in an accessible location. Dampers shall be reinforced for rigidity.
- D. Damper actuators for control dampers shall be modulating, 24V power supply, 0-10V DC control input, weatherproof construction.
- E. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards, Metal and Flexible for vanes and vane runners. Vane runners shall automatically align vanes.
- F. Manufactured Turning Vanes: Fabricate 1 1/2" wide, double vane, curved blades of galvanized steel construction set to 3/4" o.c. Support with bars perpendicular to blades set 2" o.c. and set into vane runners suitable for duct mounting.
- G. Flexible duct connectors shall be flame retardant fabrics, coatings, and adhesives complying with UL 181, Class I. Where exposed to weather, fabric shall be double coated with weatherproof, synthetic rubber resistant to UV rays.
- H. Duct access doors shall be airtight and suitable for duct pressure class, constructed of galvanized steel with insulation fill as integral part of appropriate thickness. Include cam latches, sash locks, and hinges such that doors can easily be opened without tools. Seal around frame with neoprene or foam rubber.
- I. Backdraft dampers shall be multi blade, parallel action gravity balanced, or adjustable counter-balance weighted dampers. Dampers shall have center pivoted blades of maximum 6" width, with sealed edges, assembled in rattle free manner with 90-degree stop. Provide with adjustment device to permit setting for varying differential static pressure.
- J. Fire dampers shall be UL listed and conforming to NFPA 90A. Dampers shall be factory installed in sleeves. Dampers shall be arranged to close automatically upon operation of listed fusible link.

## **2.7 REFRIGERANT PIPING**

- A. Refrigerant line kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed. Factory insulated lines with flared fittings at both ends. Mueller Streamline Co., JMF Company, or approved equal.
- B. Refrigerant pipe insulation shall be minimum 1" thick flexible closed cell elastomeric foam complying with ASTM C543 with UV retardant, and resistant to mold and mildew. Outdoor piping shall have insulation covered with .016 inch thick aluminum jacket.
- C. Refrigerant pipe insulation shall meet requirements of California Energy Code Section 120.3.

## **2.8 HANGERS AND SUPPORTS**

- A. Subject to compliance with requirements, provide products by one of the following manufacturers or other approved equal:
  - 1. B-Line.
  - 2. Mason West.
  - 3. Unistrut.

- 4. Power Strut.
- 5. Hilti.
- B. Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code. Comply with AWS D1.1 procedures for field welding.
- C. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

## **2.9 SLEEVES**

- A. Construct sleeves for pipes passing through walls, floors, partitions, hung or furred ceilings, etc. of minimum 18 gage galvanized steel, flanges on each side of wall, partition, hung or furred ceiling, etc.
- B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.
- C. Provide 20 gage galvanized sheet metal sleeves for round ductwork passing through masonry or concrete construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.
- D. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations.

## **2.10 CONTROLS**

- E. Furnish and install programmable thermostats where indicated. Coordinate exact locations with Architect.
- F. If indicated on Drawings, provide thermostats by specified manufacturer.
- G. Thermostats shall comply with latest edition of California Energy Code for demand responsive capabilities and occupancy monitoring if required.
- H. Mount thermostats 48 inches above finished floor.
- I. Control wiring shall be installed per manufacturer's instructions and wiring diagrams. Wiring in walls and exposed spaces shall be in conduit and in accordance with Division 26. Wiring above ceiling shall be plenum rated cable complying with NFPA 70.

## **2.11 PAINTING**

- A. See Division 09 for painting.
- B. Prime and paint diffuser boot and duct interiors where visible through grilles with a matte black finish.
- C. Prime and paint exposed ductwork, supports, and registers where required by the Architect.
- D. Prime and paint louver or grille interiors where required by the Architect.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions for compliance with requirements for installation clearances, tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 EQUIPMENT INSTALLATION**

- A. Equipment shall be installed level, on curbs or supports as required and/or indicated on Drawings and in accordance with manufacturer's instructions and recommendations.
- B. Equipment shall be installed in locations shown and as complete assemblies with adequate service clearances for access and maintenance as required by codes and equipment installation manuals.

### **3.3 DUCTWORK INSTALLATION**

- A. All ductwork gauges, joints, bracing, reinforcing, and other details shall be in accordance with latest edition of SMACNA manuals unless otherwise specified.
- B. Duct dimensions are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.
- C. Provide minimum 24-gauge sheet metal construction for ducts. Construct ducts with NFPA 90A gauges when traversing smoke zones.
- D. Construct ducts of galvanized sheet metal, except where otherwise indicated or specified.
- E. Construct all ductwork to dimensions indicated, straight and smooth on the inside with neatly finished joints lapped in direction of travel.
- F. Fabricate changes in direction, both horizontal and vertical, to permit easy airflow.
- G. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons fastened to the duct only.
- H. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, wiring, conduit, tubing, etc. insert through air-tight rubber grommets.
- I. Provide pitot tube openings where required for testing of systems. Include threaded metal cap, spring loaded cap or threaded plug to eliminate any air leakage. Coordinate locations of openings with balancing contractor.
- J. Install ductwork to clear all obstructions, preserve headroom, and keep openings clear. Install exposed ducts as high as possible. Coordinate with other trades to maintain minimum 7'-6" clearance above finished floor, unless otherwise indicated.
- K. Install ducts unless otherwise indicated, vertically or horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- L. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

- M. Install dampers in branch duct for all air inlets and outlets at accessible location. Dampers shall be capable of adjustments and of being locked into position.
- N. Use radius elbows in rectangular ductwork unless otherwise indicated. Centerline radius shall be a minimum 150 percent of duct width. Where space does not permit duct radius, install square elbow with turning vanes.
- O. Ends of ducts shall turn over 3/4" for airtight connections between ducts and grilles. The ducts and grilles shall have separate sets of screws. Register frames and ends of ducts shall be properly placed before finishing is begun.
- P. All ducts shall be supported per SMACNA HVAC Duct Construction Standards. Supports and seismic bracing shall be in accordance with OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.
- Q. Ducts exposed to weather shall be completely waterproof with outdoor vapor barrier mastic over tape at all joints and seams. Slope entire top of duct down towards sides and coordinate duct slope with roof slope. Arrange standing seam, joints, and flanges to prevent accumulation, ponding or pooling of water.
- R. Seal joints and seams of ductwork airtight to SMACNA seal classifications.
- S. Protect all ductwork and interiors of ducts shall be clean and free from foreign materials until building is enclosed.
- T. All ductwork and sealing shall comply with California Energy Code Section 120.4 requirements for Air Distribution System Ducts and Plenums.

### **3.4 FLEXIBLE DUCTWORK INSTALLATION**

- A. Flexible ductwork shall be installed with no runs of more than 5'-0" in length and shall be used only at register connections.
- B. Flexible duct shall be installed in fully extended condition, free of sags and kinks, using only minimum length required to make connection. Bends greater than 90° are not allowed.
- C. Flexible duct shall be full size of branch. Any change in size to match terminal connection shall be made at terminal. Connect to duct collars, terminal unit connections and air inlets and outlets per manufacturer's instructions.
- D. All connections shall be sealed with high pressure duct sealer and secured with 3/8" nylon straps around inside liner of flexible duct.
- E. Flexible ducts shall be supported at or near mid-length with 2" wide, 28 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

### **3.5 DUCT INSULATION AND LINING INSTALLATION**

- A. Concealed ductwork shall be insulated with fiberglass ductwrap.
- B. Provide acoustic lining where indicated on Drawings.

- C. All supply and return ductwork shall be insulated, or acoustically lined on the inside when ductwork is exposed.
- D. Exhaust duct need not be insulated. Outside air duct indoors need not be insulated. Outside air duct installed outdoors shall be insulated.

### **3.6 DUCT ACCESSORIES INSTALLATION**

- A. Flexible connections shall be installed on inlet and outlet duct connections of fans, air conditioning units, furnaces, and all other HVAC equipment. Fabric shall be of weight and strength for service required, properly fitted to render connection airtight. Fabric of sufficient width to provide minimum 4" between connected items.
- B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Install backdraft dampers at roof hoods or louvers connected to ductwork.
- C. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units. Access doors shall be large enough for maintenance.

### **3.7 REGISTERS, DIFFUSERS, AND GRILLES INSTALLATION**

- A. Locations indicated on the Architectural Drawings shall take precedence. For lay-in ceiling panels, locate in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- B. Install with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.
- D. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions.
- E. All visible interior surfaces of registers, diffusers, and grilles shall be painted flat black.
- F. All visible exterior surfaces of registers, diffusers, and grilles shall be factory off-white finish as standard. Where required by Architect, provide in a color as selected by Architect or provide prime-painted for field painting.

### **3.8 REFRIGERANT PIPING INSTALLATION**

- A. Refrigerant pipe installation shall comply with latest editions of ASHRAE 15 and ASME B31.5.
- B. Install piping in accordance with manufacturer's instructions and good practices.
- C. Install piping adjacent to unit to allow access to unit for service and maintenance.
- D. Where required, provide or install additional refrigerant charge per equipment manufacturer's requirements. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- E. Install piping as short and direct as possible, with a minimum number of joints and fittings.

- F. Route piping in orderly manner, parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Install piping to conserve space and avoid interference with use of space.
- G. Slope piping one percent in direction of oil return. Provide suction traps at base of suction risers where required.
- H. Piping shall be cut accurately to measurements established at job site and worked into place without springing or forcing, allowing for proper head room.
- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- J. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.
- K. Install insulation without gaps or cracks and use contact adhesive recommended by manufacturer at joints and connections.
- L. When the thickness of insulation is reduced, for example at support hangers, reinforce the reduced thickness with additional insulation.
- M. Seal longitudinal seams and end joints of insulation with manufacturer's recommended adhesive to eliminate openings in insulation. Installation to maintain a continuous vapor barrier.
- N. Where metal jackets are indicated for insulation, install with 2 inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches on center at end joints.

### **3.9 HANGERS AND SUPPORTS INSTALLATION**

- A. All equipment, plenums, registers, ductwork, and piping shall be securely anchored to building structure and seismically braced as required by the Drawings and Specifications. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.
- B. Comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible for hanger rod or sheet metal strap sizes and spacing for duct supports.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install hangers and supports to provide indicated pipe slopes.

- H. Adjust hangers to distribute loads equally on attachments.
- I. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.
- J. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding.

### **3.10 TESTING**

- A. Comply with more stringent of system manufacturer's requirements and requirement indicated herein.
- B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.
- C. After completion of refrigerant piping installation, pressurize piping systems to a test pressure of not less than 600 psig using dry nitrogen.
- D. Successful testing shall maintain the test pressure for a continuous and uninterrupted period of 24 hours.
- E. After completion of pressure testing evacuate piping systems using a vacuum pump with a check valve. Maintain test pressure per manufacturer's requirements for a continuous and uninterrupted period of one (1) hour.
- F. Prepare and submit test reports to the Architect for project record.
- G. Charge the refrigerant piping system following system manufacturer's written instructions. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

### **3.11 ADJUSTING**

- A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature setpoints. Adjust initial airflow settings and discharge airflow patterns.
- C. Set field adjustable switches and circuit breaker trip ranges according to manufacturer's written instructions.

### **3.12 FIELD QUALITY CONTROL**

- A. Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections. Provide a written report of inspection to the Architect.
- B. Engage a factory authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions. Provide completed startup sheets for each piece of equipment to the Architect.

**3.13 TRAINING AND O&MS**

- A. Refer to Section 23 00 00 Mechanical General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

**END OF SECTION**



## **SECTION 23 05 93**

### **TESTING, ADJUSTING, AND BALANCING FOR HVAC**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, Division 22, and Division 23 Specification Sections, apply to this Section.

##### **1.2 WORK INCLUDED**

- A. Test and balance air distribution systems.

##### **1.3 QUALITY ASSURANCE**

- A. Work shall be performed by independent testing agency certified by AABC or NEBB. Work shall be performed by qualified technicians and trained personnel, using instruments certified accurate to its limits.
- B. Use standard forms from AABC's National Standards for Testing, Adjusting and Balancing or NEBB's Procedural Standards for Testing, Adjusting and Balancing.
- C. Calibrate instruments at least every twelve months or more frequently if required by the instrument manufacturer.

##### **1.4 COORDINATION**

- A. Coordinate efforts of HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist with testing, adjusting, and balancing activities.
- B. Check for and report defects or deficiencies that may affect balancing.
- C. Mechanical Contractor shall advise Balancing Contractor of changes made to the system during construction.
- D. Mechanical Contractor shall install test holes or wells complete with removable and replaceable plugs or caps, dampers as specified on Drawings and where required by Balancing Contractor to obtain final system balance.
- E. Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, or the addition of dampers for the correct balance as recommended by Balancing Contractor at no additional cost to the Owner.
- F. Controls Contractor shall cooperate with and work with the Balancing Contractor when setting damper linkages, minimum outside air dampers, and other air volume devices, and shall be available for readjusting of dampers, devices or controls.

##### **1.5 SUBMITTALS**

- A. Within 30 days of Contractor's Notice to Proceed, submit the following documents:

1. TAB agency and team member qualifications.
  2. Strategies and procedures plan.
  3. Sample report forms intended for use on this project.
  4. Instrument calibration reports.
- B. Submit final, completed balance report prior to request for final mechanical observation of the project.

## **PART 2 – PRODUCTS**

### **2.1 INSTRUMENTS**

- A. Utilize test instruments and equipment of type, precision, and capacity as recommended in the AABC or NEBB standards.
- B. Instruments for testing and balancing of air and hydronic systems shall have been calibrated within a period of 6 months and verified for accuracy prior to start of work.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Prior to construction, examine the Contract Documents to become familiar with the project requirements and to discover conditions in the systems' designs that may preclude proper testing, adjusting and balancing of systems and equipment.
- B. Examine system and equipment installations to verify that balancing devices are properly installed and accessible for effective balancing.
- C. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.

### **3.2 GENERAL PROCEDURE**

- A. Perform testing and balancing procedures on each system according to procedures contained in AABC or NEBB standards.
- B. Testing and balancing shall not begin until system has been completed and is in full working order.
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation or test probes to the minimum extent necessary for balancing procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this project.
- D. Permanently mark settings on valves, splitters, dampers, and other adjustment devices.
- E. Balance to a maximum measured flow deviation from specified values of plus or minus 10 percent at terminal devices and outlets, and plus or minus 5 percent at equipment.
- F. At final inspection, recheck random selections of data recorded in report to verify balance has not been disrupted.

### **3.3 AIR SYSTEMS PROCEDURE**

- A. Execute air systems balancing for each air system in accordance with AABC or NEBB standards and as described herein.
- B. Conduct tests with supply, return and exhaust systems operating and doors and windows closed or in their normal operating condition.
- C. Construction filters shall be removed before testing and balancing. Tests shall be done with final filters installed. Allowances shall be made for air filter resistance at time of tests. The main air supplies shall be set with filter resistance midway between clean and dirty filters.
- D. Test and adjust fan or blower speed to design requirements.
- E. Test and record motor full load amps. Record each installed motor manufacturer and motor efficiency.
- F. Traverse main supply air ducts, using a pitot tube and manometer.
- G. Submit data in support of fan deliveries by the following methods:
  - 1. By summation of the air quantity readings at inlets or outlets.
  - 2. By duct traverse of main ducts.
- H. Test and record required and measured system static pressures; filter differential, coil differential and fan total static pressure.
- I. Test and adjust systems for design recirculated airflow rates.
- J. Test and adjust system for outside airflow rates. Measure and adjust outside airflow rates for all fan speeds.
- K. Test and record entering and leaving air temperatures.
- L. Inspect and confirm all fire dampers are open, all smoke dampers and fire/smoke dampers are in the correct positions, all duct access doors are closed and fire damper fusible links are accessible.
- M. Adjust zones to proper design supply, return, and exhaust flow rates.
- N. Test and adjust each air inlet and air outlet and transfer duct to within 10 percent of design requirements.
- O. Adjust diffusers, grilles and registers to minimize drafts, dumping, and to prevent short circuiting between supply and return outlets.
- P. Vary total system airflow rates by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- Q. Record installed fan drive assemblies; fans sheaves, motor sheaves, belts and motors.

- R. The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-story buildings, test pressure conditions at ground, intermediate and upper levels. Front doors, stair and vestibule doors, exits and elevator shafts shall be checked for airflow so that leakage does not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.
- S. Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.02 inch wg minimum and 0.05 inch wg maximum shall be achieved, measure with negligible outside wind velocity.
- T. Test and adjust each power exhaust fan to achieve building pressure requirements.

### **3.4 ACCEPTANCE**

- A. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Architect are obtained.
- B. If it is found that specified airflows cannot be achieved on portions of the system, the actual conditions shall be reported to the Architect for consideration of corrective action.

### **3.5 BALANCE REPORT**

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
- B. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB firm and specialist.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Summary of contents including the following:
    - a. Design versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
- C. Report shall be indexed as follows:
  - 1. Air

- a. Summary.
- b. Procedure.
- c. Instrumentation.
- d. Drawings.
- e. Equipment Summary.
- f. Fan Sheets.
- g. Fan Curves.
- h. Fan Profile Data.
- i. Static Data.
- j. Traverse Data and Schedule.
- k. Terminal Unit Summary.
- l. Outlet Data Summary and Schematics (per system).
- m. Building Pressurization Data.

**END OF SECTION**

## **SECTION 23 08 00**

### **COMMISSIONING OF HVAC SYSTEMS**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. The General Conditions, any Supplementary Conditions, Section 23 05 00, Heating Ventilation and Air Conditioning, and Division 01 are hereby a part of this Section as fully as if repeated herein.

##### **1.2 SCOPE OF WORK**

- A. Work includes performing commissioning process requirements for HVAC systems including mechanical controls, assemblies, and equipment.
- B. Refer to Section 01 91 00 General Commissioning Requirements for general commissioning process requirements.

##### **1.3 DEFINITIONS**

- A. See 01 91 00 General Commissioning Requirements for definitions.

##### **1.4 CONTRACTOR'S RESPONSIBILITIES**

- A. See 01 91 00 General Commissioning Requirements for contractors' and subcontractors' responsibilities.
- B. Provide training on each piece of commissioned equipment. See 01 91 00 for training details.

##### **1.5 CA RESPONSIBILITIES**

- A. See 01 91 00 General Commissioning Requirements for CA responsibilities

##### **1.6 COMMISSIONING DOCUMENTATION**

- A. Provide the following information to the CA for inclusion in the commissioning plan:
  - 1. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
  - 2. Schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC systems, assemblies, equipment, and components to be commissioned.
- B. Provide the following as discussed in Section 01 91 00, General Commissioning Requirements to General Contractor:

1. Completed system readiness checklist for each piece of commissioned equipment. Completion of system readiness checklist, O&M manual start-up checklist, and any manufacturer provided field start-up checklists.
2. Verification to GC readiness certifying that HVAC systems, subsystems, equipment, and associated controls are ready for functional testing.
3. Corrective action documents resulting from issues in the Commissioning Issues Log or deficiencies found from completing the start-up plan.

## **1.7 SUBMITTALS**

- A. Updated submittals: keep the CA informed of all changes to the control system documentation made during programming and setup.
- B. Certificates of readiness (completion of the system readiness checklist) to General Contractor for review by CA.
- C. Written training plan for review by A/E and CA prior to training. See Section 01 91 00 General Commissioning Requirements for specific items to be included in the training plan.
- D. Provide O&M manuals to GC for submission to CA. These are required prior to development of the system readiness checklists.

## **PART 2 – PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing.
- B. Equipment-specific tools: where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or functional testing, provide such equipment, tools, and instruments as part of the work at no extra cost to owner; such equipment, tools, and instruments are to become the property of owner.

## **PART 3 – EXECUTION**

### **3.1 PARTICIPATION**

- A. The contractor shall provide skilled technicians to startup and debug all systems. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Contractor(s) shall ensure that the qualified technician(s) are available and present during the agreed upon schedules to complete the necessary tests, adjustments, and/or problem resolutions.
- B. System performance problems and discrepancies may require additional technician time, Commissioning Authority time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

### **3.2 TESTING PREPARATION**

- A. Cooperate with the CA in development of the functional test procedures.

- B. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- C. Certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- D. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- E. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions) as required in functional testing.
- F. Provide test holes in ducts and plenums where directed by testing and balance subcontractor to allow air measurements and air balancing. Provide approved plugs.
- G. Provide temperature and pressure taps according to contract documents for testing and balance, and commissioning tests.
- H. Provide input to GC on construction schedule to include division pipe and duct system testing, flushing, and cleaning. Provide input on equipment start-up and testing and balance schedule to GC. Notify the CA when these items are scheduled.
- I. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- J. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CA.
- K. Certify that all related A/E punch list items are complete prior to commencing functional tests.
- L. Correct deficiencies found from completing the start-up plan prior to conducting functional tests.
- M. Provide full points list and keep CA informed of changes in list during programming and setup.

### **3.3 TESTING AND BALANCE VERIFICATION**

- A. Prior to performance of testing and balancing work, provide copies of reports, sample forms, checklists, and certificates to the CA.
- B. Notify the CA at least ten (10) days in advance of testing and balancing Work, and provide access for the CA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the CA.
- D. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.



- E. The CA will notify testing and balancing Subcontractor five (5) days in advance of the date of field verification.
- F. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
- G. Failure of an item includes not meeting acceptance criteria as discussed in 23 05 93 Testing, Adjusting, and Balancing for HVAC. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report.
- H. Remedy the deficiency and notify the CA so verification of failed portions can be performed

### **3.4 GENERAL TESTING REQUIREMENTS**

- A. System readiness checklists and functional test forms will be provided by CA, and executed by installing subcontractors. System readiness checklists are part of the start-up plan that will be provided by the CA to the GC. The GC will distribute the forms and ensure their completion prior to submitting back to the CA for review.
- B. CA will oversee execution of the functional tests. Functional tests are provided early to obtain any comments or suggestions.
- C. Provide installing technicians, instrumentation, and tools to perform commissioning test at the direction of the CA.
- D. Provide skilled technicians who are familiar with this building to execute the functional tests as directed by the CA.
- E. Scope of HVAC testing shall include entire HVAC installation, from central equipment for heat generation and air conditioning through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- F. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- G. Tests will be performed using design conditions whenever possible.
- H. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- I. The CA may direct that set points be altered when simulating conditions is not practical.
- J. The CA may direct that sensor values be altered when design or simulating conditions and altering set points are not practical.
- K. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the CM and GC. After deficiencies are resolved, coordinate with CA to reschedule tests.

- L. Installing subcontractor shall be present during all functional tests, whether sub-contractor's equipment is directly involved with the test or not. This is to speed the process of problem resolution as they are discovered during the testing process.

### **3.5 HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES**

- A. HVAC Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in mechanical drawings and functional tests (provided by CA) during construction phase.
- B. HVAC Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems; including HVAC terminal equipment and unitary equipment.
- C. See 01 91 00 General Commissioning Requirements for contractor's retesting procedures.

### **3.6 CONTROL SYSTEM TESTING PROCEDURES**

- A. Provide a skilled technician who is familiar with this building to execute the functional tests as directed by the CA.
- B. Demonstrate the following to the CA during testing of controlled equipment:
  - 1. Setpoint changing features and functions
  - 2. Sensor calibrations
  - 3. Specified functions and features are set up, debugged, and fully operable
  - 4. Graphic screens and value readouts are completed

### **3.7 TRAINING**

- A. Provide training on each piece of commissioned equipment. See 01 91 00 and Division 23 for training details.
- B. Trainer must be familiar with this building and equipment. Have the technicians that performed work on this building available for answering questions.

**END OF SECTION**

## **SECTION 23 09 22**

### **CLIMATE MANAGEMENT CONTROL FOR HVAC**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, Division 22, and Division 23 Specification Sections, apply to this Section.

##### **1.2 CONTROL SYSTEM DESCRIPTIONS**

- A. The Building Automation System (BAS) shall be as indicated on the drawings and described in these specifications. System shall include a network of commercial Internet-programmable thermostats, their accessories, and any other networked devices required for complete climate management. Devices shall communicate across a wireless network using IEEE 802.15.4 technical standards. A single Ethernet-connected Gateway shall be able to connect the wireless mesh network to the Internet, allowing for climate management through a cloud based web-application.
- B. Access and control of BAS shall be through a web-based graphical management platform. The BAS platform shall sit on a cloud server and be accessible on both local personal computers and remotely by use of a web-browser that supports HTML5 or later.
- C. No on-site servers are to be installed or used for the BAS. No licensing fees or future licensing fees shall be required as part of the BAS. These specifications and guidelines are to create a cohesive and secure network that provides full management over the facility's climate through the cloud BAS.
- D. The BAS shall accommodate an unlimited simultaneous multiple-user operation. Access to the BAS shall be limiting based on security permissions of each operator's role managed by owner site Administrators.

##### **1.3 CODES AND STANDARDS**

- A. Codes and Standards. Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section:
  - 1. California 2019 Title 24 Compliant
  - 2. California Energy Commission Occupant Control Smart Thermostat (OCST) certified
  - 3. OpenADR 2.0 certified

##### **1.4 APPROVED BUILDING AUTOMATION SYSTEM MANUFACTURERS**

- A. Pelican Wireless Systems.

## **1.5 SUBMITTALS**

- A. Shop drawings and manufacturer's standard specification data sheets on all hardware shall be provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.
- B. Shop drawings shall include basic floor plans depicting locations of all equipment and wiring to be controlled by system and locations of thermostats, gateways, and other equipment provided under this section. Drawings shall also show location of electrical power, low voltage wiring and data ports required for proper installation of systems of this section.
- C. Shop drawings shall include wiring diagrams and sequences of operation.
- D. The Contractor prior to submitting shall check all documents for accuracy.
- E. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

## **1.6 WARRANTY**

- A. The contractor shall warrant the system for 12 months after system acceptance and beneficial use by the owner. During the warranty period, the contractor shall be responsible for all necessary revisions as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. BAS equipment shall include a limited-warranty by the manufacturer for a period of five (5) years from the time of system acceptance.
- B. Limited-warranty by manufacturer is limited to replacement of defective products.

## **PART 2 – PRODUCTS**

### **2.1 COMMUNICATION**

- A. This project shall be comprised of a network of devices that use an IEEE 802.15.4 self-creating and self-healing wireless mesh communication network to reach an Ethernet Gateway.
- B. The Gateway shall communicate to cloud servers via a single Ethernet connection at the owner's wide area network (WAN) over a TCP/IP connection. The facility's firewall shall not require any inbound port assignments for the Gateway to connect to the cloud servers. The Gateway shall not require a Public IP.

### **2.2 OPERATOR INTERFACE**

- A. The BAS shall be controlled, managed, and configured using a Web-App on any personal computer, smartphone, and/or tablet that runs a browser with HTML5 or newer.
- B. The Web-App platform shall run on cloud servers which allow for virtual access. Platform shall not run on a local on-site server.
- C. The Web-App shall support at a minimum, the following functions:

1. Personal user log-on identifications (email addresses) and unique passwords shall be required.
2. Custom HTML programming shall not be required to display any graphics, data, or build the Web-App. There shall be no development cost, commissioning costs, or software upgrade cost required to obtain and use the Web-App.
3. Storage of historical data shall reside on the cloud server and shall not sit within the client's computer, internal network, or other devices.
4. System shall allow for administrator and user defined access privileges.
5. A Push/Pull OpenAPI interface with XML data output shall be available.

D. Control and Override

1. The BAS shall provide view, override, and edit of the status of any object and property in the system. The status of the device shall be defined graphically and shall not require any custom programs or programming.
2. Temporary Overrides. The BAS shall be able to provide temporary override (wherever an override is allowed) and automatically remove the override after a specified period of time.
3. Any override and edit of an object virtually or at the device, if allowable, shall be historically tracked.

E. Scheduling

1. The BAS shall provide users with scheduling of application devices through a graphical interface. Scheduling shall include, but is not limited to:
  - a. Occupied/Unoccupied Schedules. Shall allow 12 scheduled set-time changes in a single day, be configurable for Daily, Weekly, and Weekday/Weekend layouts, and shall be able to be unique to individual devices or easily shared between multiple devices, where applicable.
  - b. Event Schedules. Shall allow for advanced one-time or repeating event type schedules. Event schedules shall override Occupied/Unoccupied Schedules. After the Event schedule ends, the device shall revert back to the Occupied/Unoccupied Schedule automatically.
  - c. Vacation Schedules. A 360-day Calendar shall provide override of schedules during vacation days. Thermostats shall be able to automatically or be manually switched to follow Vacation Schedules instead of Occupied/Unoccupied Schedules.

F. Alarm Notification

1. Alarm Notification(s) shall be generated if there are failures detected by devices part of the BAS. These failures shall be, but are not limited to: temperature deviations, temperatures missing targets, temperatures too high or too low, failures of equipment, etc. Alarm Notification(s) shall be posted on the BAS and shall be able to be sent either via email or text message to an unlimited number of users.

G. Reports and Logs

1. Data shall be logged and stored on cloud servers for all devices part of BAS in real-time. Every device real-time "state change", when applicable, shall be stored and viewable for at least one week, with the option of up to two (2) years.

- a. Each space temperature
  - b. Each temperature set point(s)
  - c. Each current call: heat, cool, number of stages, fan, economizer, etc.
  - d. Each damper position
  - e. Each valve position
  - f. Each CO<sub>2</sub> change
  - g. Each CO<sub>2</sub> setting
  - h. Each current call for ventilation due to high CO<sub>2</sub>
  - i. Each Fan speed adjustment
  - j. Supply, Return, Outside air temperatures
2. Data shall be represented on historical graphs that allow for easy viewing of device state change at different times.

## **2.3 APPLICATION-SPECIFIC CONTROLLERS**

- A. Application Specific Controllers shall not require custom programming and shall control specific equipment through simple configuration settings done through the cloud-based BAS. All configuration changes shall automatically upload into the device once set on the BAS and shall be stored by the device's internal memory.
- B. Configuration of Devices and System
  1. To meet the sequence of operation for each controller, the controller shall be configured through the BAS by the installing contractor. No custom programming or downloading by use of a service tool shall be required.
  2. Stand-Alone Operation: Each piece of equipment specified shall provide stand-alone operation. BAS devices shall not require web connection or communication to the BAS to run under normal operations.
- C. Gateways are devices which connect to an Ethernet port and act as a bridge between the BAS cloud servers and the wireless mesh network.
  1. Shall be capable of providing Internet connection to up to 2,000 devices.
  2. Shall be capable of automatically addressing routing tables to all devices part of wireless mesh network and shall not require manual programming or addressing.
  3. Shall communicate to cloud servers over a TCP/IP outbound-only connection.
  4. Shall not require a Public IP address, custom VPNs, or any on-site servers.
  5. Shall communicate to other BAS devices over the dedicated and isolated 802.15.4 IEEE technical standard.
  6. Shall be secured using AES (Advanced Encryption Standards).
- D. Internet-Enabled Thermostats are controllers which detect a space/zone temperature and operate equipment or dampers which supply heating, cooling, ventilation, or a combination of the three mechanical states, to their space/zone.

1. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: two stages of fan, three stages of cooling, two stages of heating, one stage of auxiliary heat (heat pumps), floating point zone dampers, two position zone dampers.
  2. Shall include a removable wiring terminal module that allows for thermostat installation even in situations where there are only three wires between equipment and where the thermostat is to be installed.
  3. Shall be available with the following internal sensors: temperature only, temperature and humidity, temperature, humidity, and CO<sub>2</sub>, and temperature and CO<sub>2</sub>. All sensors required by the specifications are to be internal to the thermostat and not require two devices on the wall.
  4. Shall be able to accept expansion accessories that allow for more advanced control sequences, and additional temperature detection.
  5. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
  6. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
  7. Shall automatically push, in real-time, to the BAS all "state changes" so as to be viewable historically and in real-time from BAS.
  8. Shall be able to lock-out heat pump compressor(s) based on outside air temperature.
  9. Shall provide set-point (heat & cool) temperature limitations through BAS.
  10. Shall provide full local keypad lock-out from BAS.
  11. Shall meet California Title 24 code standards.
  12. Shall have both a heat setpoint, cool setpoint, and auto-changeover.
  13. Shall have Optimum Start algorithms that will calculate start times based on at least seven (7) days of previous run-time temperature and rate-of-change historical data for its space. Optimum Start algorithm shall recalculate each optimized schedule time before each optimized schedule.
  14. Shall be able to be manually overridden through BAS.
  15. Shall be configured through BAS.
- E. Wired Temperature Inputs are to be available to provide external temperature detection for specific BAS devices.
1. Shall accept 10K type II thermistors.
  2. Shall push to the BAS real-time temperature changes so as to be viewable historically and in real-time from the BAS.
  3. Shall accept a thermistor at a maximum of up to 100 feet from input terminal.
  4. Shall be configured through the BAS.
- F. Internet-Enabled Economizer Controller are controllers that modulate an outside air damper to provide ventilation and economization to a single zone.
1. Shall only require a dry-bulb outside air temperature sensor and dry-bulb supply air temperature sensor.

2. Shall communicate with thermostat to determine space temperature and space temperature setpoint in order to decide when economization can be used.
  3. Shall continue to economize as its only source of cooling as long as the outside air temperature is able to keep the space temperature within 1°F of the cool temperature setpoint.
  4. Shall be able to enable mechanical cooling at the same time as economization.
  5. Shall be able to prevent the supply air temperature from dropping below a minimum temperature.
  6. If connected to a CO<sub>2</sub> thermostat, shall be able to provide demand ventilation control of outside air damper.
  7. Shall have a minimum ventilation damper position and a maximum ventilation damper position.
  8. Shall be able to be scheduled to not open the outside air damper for ventilation during unoccupied hours.
  9. Shall be able to control a Variable Frequency Drive (VFD) with up to five (5) fan speed inputs.
  10. Shall modulate an outside air damper by use of a 0-10VDC signal.
  11. Shall accept a 0-10VDC signal feedback input from the outside air damper actuator to confirm outside air damper is working correctly.
  12. Shall meet all California Title 24 codes, including Fault Detection and Diagnostic requirements.
  13. Shall send Fault Detection and Diagnostic information to the BAS.
  14. Shall accept a minimum of three (3) 10K type II thermistors.
  15. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from BAS.
  16. Shall be able to be manually overridden through the BAS.
  17. Shall be configured through the BAS.
- G. Internet-Enabled Power Relay Module are controllers which have dry-contact relays able to start/stop different electrical equipment. Examples are exhaust fans, lights, pumps, valves, boilers, chillers, etc.
1. Shall have relays with a max rating of 120 VAC @ 15 AMPs or 240/277 VAC @ 10 AMPs.
  2. Shall have a low-voltage terminal for momentary contact override inputs. Override time shall be configurable for a specific amount of minutes through a configuration from the BAS.
  3. Shall be able to provide Lead/Lag sequencing between relays.
  4. Shall be able to accept an external dry-contact input.
  5. Shall communicate with the wireless mesh network through an external wireless antenna that runs on the 802.15.4 technical standards. Antenna shall be able to communicate with Power Relay Module over three (3) 18-gauge wires up to 500 feet between device terminal inputs.



6. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
  7. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in relay positions On or Off.
  8. Shall be able to be manually overridden through the BAS.
  9. Shall be configured through the BAS.
- H. Make-up Air Controllers which operate equipment supplying ventilation to the building.
1. Shall communicate with the wireless mesh network through a removable wireless antenna that runs on the 802.15.4 technical standards.
  2. Remote mountable antenna shall be able to communicate to Controller over three (3) 18-gauge wires up to 500 feet between devices terminal inputs.
  3. Communication from the Controller to zone/space Thermostat(s) shall be over the wireless mesh network.
  4. Shall be capable of providing 24VAC outputs which can be configured to provide control of the following: multiple stages of fan, multiple stages of cooling, and multiple stages of heating.
  5. Shall be capable of providing 0-10VDC outputs which can be configured to provide control of the following: modulating variable speed fan (VFD), modulating outside air damper, modulating heating, modulating cooling.
  6. Shall be able to modulate a VFD to maintain a targeted building static pressure.
  7. Shall have integrated outside air damper control logic.
  8. Shall directly accept a building pressure probe. Shall have an integrated short-term and long-term learning PID loop algorithm for maintaining target building pressure. PID loop shall not require any type of cost for programming, is to be factory loaded into controller, and updatable virtually through EMS.
  9. Shall only require dry-bulb outside and supply air temperature sensors.
  10. If communicating to CO<sub>2</sub> thermostat(s), shall be able to provide demand ventilation control of outside air damper.
  11. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS. Examples are changes in equipment operation (heat, cool, fan, economization, ventilation), number of stages active, the supply air temperature, the return air temperature, the outside air temperature, hot water valve position, supply duct static reading, variable speed fan setting, etc.
  12. Shall be scheduled On or Off through the BAS.
  13. Shall be able to be manually overridden through the BAS.
  14. Shall be configured through the BAS.
- I. Wireless Proximity Sensors are thermostat accessories which are able to detect when a door or window is opened or closed, or be able to accept a dry-contact input from an occupancy sensor.
1. Shall be able to communicate to a single Internet-Programmable Thermostat over wireless mesh network.

2. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
  3. Shall run on two AA batteries and not require any unique type of battery to operate.
  4. Shall push all "state changes" to the BAS as to be viewable historically and in real-time from the BAS.
  5. Shall be configured through the BAS.
- J. Wireless Repeaters are devices which extend the 802.15.4 wireless mesh network across large expanses or where BAS devices are unable to repeat the wireless mesh network on their own.
1. Shall communicate with the wireless mesh network through an internal wireless antenna that runs on the 802.15.4 technical standards.
  2. Shall be able to automatically repeat the wireless mesh network to additional devices part of the BAS.
  3. Shall not require an Ethernet connection or any TCP/IP connection.
  4. Shall only require a single 120V outlet for power.

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

- A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The BAS manufacturer shall be available to provide assistance to contractor in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

#### **3.2 PROTECTION**

- A. The installing contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.
- B. The installing contractor shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.
- C. Installation of BAS shall be performed by an approved Contractor. Approved contractor is one whom either has installed the BAS before or has been approved by the BAS manufacturer. The Contractor shall certify all work as proper and complete. Under no circumstance shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor unless that subcontractor meets the BAS approved Contractor requirements as stated above.

- D. Demolition. Remove controls which do not remain as part of the BAS. The owner will inform the Contractor of any equipment which is to be removed that will remain the property of the owner. All other equipment which is remove will be disposed of by the Contractor.
- E. Code Compliance. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations.
- F. Clean Up. During installation, contractor shall maintain a clean environment. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

### **3.3 HARDWARE INSTALLATION**

- A. All devices are to be mounted level/plumb and per the manufacturer's installation documentation.
- B. Identification.
  - 1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
  - 2. All field enclosures, other than controllers, shall be identified with a nameplate. The lettering shall be in white against a black or blue background.
  - 3. Junction box covers will be marked to indicate that they are a part of the BAS.
  - 4. All field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
  - 5. All field devices inside FIP's shall be labeled.
- C. Existing controls are not to be reused. All BAS devices will be new.
- D. Location.
  - 1. The location of sensors is as indicated in the mechanical and architectural drawings.
  - 2. Space temperature, humidity, and CO<sub>2</sub> sensors will be mounted away from machinery generating heat, direct light, and/or diffuser air streams.
  - 3. If external temperature sensors are installed, sensors will be mounted away from machinery generating heat, direct light, and/or diffuser air streams.
  - 4. If outdoor air temperature sensors are installed, sensors are to be installed such that the effects of heat radiated from the building or sunlight is minimized.

### **3.4 SYSTEM CONFIGURATION**

- A. General. The installing contractor shall provide all labor necessary to install, initialize, start-up and troubleshoot all system hardware and configurations described in this section. This includes any requirements necessary to access the web application on third-party devices.

- B. Installing contractor shall work with owner's representative to determine configuration parameters including but not limited to hours of operation, set points, system variables, naming of devices, and site naming. Naming of devices and the site shall be performed by the installing contractor. Naming convention of space thermostats shall be space served. Naming convention of zone controllers shall be the equipment serial number. All naming shall be provided by or agreed upon with the owner.

### **3.5 SYSTEM STARTUP & COMMISSIONING**

- A. Each BAS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation. Documentation shall be provided to the owner that proves installation and testing has been completed. Successful completion of the system tests shall constitute the beginning of the warranty period.
- B. The contractor shall provide all manpower required to assist the Balancing Contractor in testing, adjusting, and balancing all systems in the building. The contractor shall have a trained technician available on request during the balancing of the systems. The contractor shall include all labor and materials in his contract to assist with functional testing of system as it relates to the BAS.
- C. Upon completion of installation, the following documents shall be submitted for approval prior to final completion and include:
  - 5. Testing and Commissioning Reports and Checklists signed off by trained field commissioning personnel.
  - 6. Name, address and telephone number of Contractor personnel managing and installing equipment, along with service personnel responsible for supporting the ongoing warranty and services of the control system.
  - 7. Procedures for operating the BAS, including logging on/off, alarm management, reading reports, trends, modification of setpoints, scheduling, and other interactive system requirements.
  - 8. Provide information on how to receive support from Pelican Wireless Systems and communicate that they are a direct supporting resource.

### **3.6 TRAINING**

- A. The Contractor shall provide training for owner representatives and/or maintenance personnel.
- B. On-site training shall consist of a minimum of (3) hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include:
  - 1. System Overview
  - 2. System Application and Operation
  - 3. System Access
  - 4. Application Features Overview
  - 5. Changing Set Points and other attributes
  - 6. Scheduling
  - 7. Editing configurable variables

8. Graphics
9. Viewing Historical Reports
10. Operational sequences including start-up, shutdown, adjusting and balancing
11. Equipment maintenance

### **3.7 OPERATING AND MAINTENANCE MANUALS**

- A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire BAS.
- B. Following project completion and testing, the BAS contractor will submit as-built documentation reflecting the exact installation of the system.

**END OF SECTION**

## **SECTION 23 81 29**

### **VARIABLE REFRIGERANT FLOW SYSTEM**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 23 Sections apply to this Section.

##### **1.2 PREINSTALLATION MEETING**

- A. Conduct a preinstallation meeting one week prior to the start of the work of this Section. Require attendance by all affected installers.

##### **1.3 SUBMITTALS**

- A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies for the following.
- B. Product Data:
  - 1. Indoor concealed ceiling horizontal or cassette type fan coil units.
  - 2. Outdoor air cooled vertical discharge, variable refrigerant flow heat pump.
  - 3. Individual unit temperature controllers.
  - 4. System refrigerant piping, fittings, and insulation.
  - 5. VRF manufacturer provided central controls system.
  - 6. Equipment and piping supports.
- C. Shop Drawings:
  - 1. Details of equipment assemblies, indicating dimensions, weights, loads, required clearances, method of assembly, method of fan coil and condensing unit installation, components, and location and size of each field connection.
  - 2. Power, signal, and control wiring diagrams including detailed wiring diagrams that clearly differentiate between manufacturer-installed and field-installed wiring.
- D. Qualification Data:
  - 1. Certificate from VRF system manufacturer certifying that installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

##### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  - 1. Nationally recognized manufacturer of VRF HVAC systems and products.

2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of five (5) years.
- B. Installer Qualifications:
  1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
  2. Installer certification shall be valid and current for duration of Project.
  3. Installer shall have demonstrated past experience with products being installed for period within five (5) consecutive years before time of bid.

## **PART 2 – PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Trane-Mitsubishi.
- B. Samsung HVAC.
- C. Daikin.

### **2.2 EQUIPMENT**

- A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

### **2.3 REFRIGERANT PIPING**

- A. Refer to Section 23 05 00 for piping requirements.
- B. Utilize manufacturer recommended piping connector fittings with molded insulation covers to connect multiple evaporators.
- C. Where multiple outdoor units are required, utilize manufacturer supplied connectors with insulation covers.

### **2.4 HANGERS AND SUPPORTS**

- A. Refer to Section 23 05 00 for requirements.

### **2.5 CONTROLS**

- A. Furnish and install programmable thermostats where indicated. Coordinate exact locations with Architect.
- B. If indicated on Drawings, provide thermostats by specified manufacturer.
- C. Thermostats shall comply with latest edition of California Energy Code for demand responsive capabilities and occupancy monitoring if required.
- D. Provide required centralized controller and thermostat adapters as required by VRF system manufacturer for proper operation and control of system.

- E. Mount thermostats 48 inches above finished floor.
- F. Control wiring shall be installed per manufacturer's instructions and wiring diagrams. Wiring in walls and exposed spaces shall be in conduit and in accordance with Division 26. Wiring above ceiling shall be plenum rated cable complying with NFPA 70.

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and conditions with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that roughing in for refrigerant piping, condensate piping, and required electrical services have been installed and in proper locations prior to starting installation.
- C. Notify Architect if conditions for installation are unsatisfactory. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 EQUIPMENT INSTALLATION**

- A. Install in accordance with manufacturer's instructions. Maintain manufacturer's recommended clearances for service and maintenance. Maintain clearances required by governing codes.
- B. Install units to be level and plumb while providing a neat and finished appearance.
- C. Unless otherwise required by the VRF system manufacturer, support ceiling mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
- D. Install outdoor units on support structures indicated on Drawings.
- E. Provide seismic restraints and lateral bracing if needed to limit movement of suspended units.
- F. Protect finished surfaces of ceilings, floors, and walls that come in contact with units. Refinish or replace damages areas after units are installed.
- G. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
- H. In room without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance. Prime and paint as required by the Architect.

#### **3.3 REFRIGERANT PIPING INSTALLATION**

- A. Refer to Section 23 05 00 for requirements.

#### **3.4 HANGERS AND SUPPORTS INSTALLATION**

- A. Refer to Section 23 05 00 for requirements.



### **3.5 FIELD QUALITY CONTROL**

- A. Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping, controls, and electrical connections. Provide a written report of inspection to the Architect.
- B. Engage a factory authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions. Provide completed startup sheets for each piece of equipment to the Architect.
- C. Engage a factory authorized service representative to train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.
- D. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.
  - 1. First Visit: Kick-off meeting.
  - 2. Second Visit: At approximately 50% completion of systems.
  - 3. Third Visit: Final inspection before system startup.
  - 4. Fourth Visit: System startup. Visit may be combined with third visit if no corrections are required after inspection and startup can be completed on same visit.
  - 5. Fifth Visit: Training.
- E. Kick-off Meeting: Meeting shall include all related trades with sole purpose of reviewing VRF system installation requirements and close coordination required to make a successful installation.

### **3.6 TRAINING AND O&MS**

- A. Refer to Section 23 00 00 Mechanical General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

**END OF SECTION**

**SECTION 26 05 00**

**GENERAL ELECTRICAL REQUIREMENTS**

**PART 1 – GENERAL**

**1.01 Description of Work:**

- A. The work of this Section consists of providing all required labor, supervision, materials and equipment to satisfactorily complete all electrical installations that are shown on the Drawings, included in these specifications, or otherwise needed for a complete and fully operating facility.
- B. Furnish and install all required in-place equipment, conduits, conductors, cables and any miscellaneous materials for the satisfactory interconnection and operation of all associated electrical systems.

**1.02 Related Work:**

- A. This Section provides the basic Electrical Requirements which supplement the General Requirements of Division 01 and apply to all Sections of Division 26.

**1.03 Submittals:**

- A. As specified in Division 01. Submit to the Architect shop drawings, manufacturer's data and certificates for equipment, materials and finish, and pertinent details for each system specified. Information to be submitted includes manufacturer's descriptive literature of cataloged products, equipment, drawings, diagrams, performance and characteristic curves as applicable, test data and catalog cuts. Obtain written approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Furnish manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable Federal, Industry and Technical Society Publication References, and years of satisfactory service of each item required to establish contract compliance. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval.
- B. Organize submittals for equipment and items related to each specification section together as a package.
- C. Proposed substitutions of products will not be reviewed or approved prior to awarding of the Contract.
- D. Substitutions shall be proven to the Architect or Engineer to be equal or superior to the specified product. Architect's decision is final. The Contractor shall pay all costs incurred by the Architect and Engineer in reviewing and processing any proposed substitutions whether or not a proposed substitution is accepted.
- E. If a proposed substitution is rejected, the contractor shall furnish the specified product at no increase in contract price.
- F. If a proposed substitution is accepted, the contractor shall be completely responsible for all dimensional changes, electrical changes, or changes to other work which are a result of the substitution. The accepted substitution shall be made at no additional cost to the owner or design consultants.

1.04 Quality Assurance:

- A. Codes: All electrical equipment and materials, including installation and testing, shall conform to the latest editions following applicable codes:
  - 1. California Electrical Code (CEC).
  - 2. Occupational Safety and Health Act (OSHA) standards.
  - 3. All applicable local codes, rules and regulations.
  - 4. Electrical Contractor shall possess a C-10 license and all other licenses as may be required. Licenses shall be in effect at start of this contract and be maintained throughout the duration of this contract.
- B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply.
- C. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA).
- D. Underwriter Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Provide service entrance labels for all equipment required by the NEC to have such labels.
- E. The electrical contractor shall guarantee all work and materials installed under this contract for a period of one (1) year from date of acceptance by owner.
- F. All work and materials covered by this specification shall be subject to inspection at any and all times by representatives of the owner. Work shall not be closed in or covered before inspection and approval by the owner or his representative. Any material found not conforming with these specifications shall, within 3 days after being notified by the owner, be removed from premises; if said material has been installed, entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the contractor.

1.05 Contract Documents:

- A. Drawings and Specifications:
  - 1. In the case of conflict between the drawings and specifications, the specifications shall take precedence.
  - 2. Drawings and specifications are intended to comply with all law, ordinances, rules and regulations of constituted authorities having jurisdiction, and where referred to in the Contract Documents, said laws, ordinance, rules and regulations shall be considered as a part of said Contract Documents within the limits specified. The Contractor shall bear all expenses of correcting work done contrary to said laws, ordinance, rules and regulations if the Contractor knew or should have known that the work as performed is contrary to said laws, ordinances, rules and regulations and if the Contractor performed same (1) without first consulting the Architect for further instructions regarding said work and/or (2) disregarded the Architect's instructions regarding said work.

- B. Drawings: The Electrical Drawings shall govern the general layout of the completed construction.
1. Locations of equipment, panels, pullboxes, conduits, stub-ups, ground connections are approximate unless dimensioned; verify locations with the Architect prior to installation.
  2. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for those installations.
  3. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Architect for approval.
  4. The general arrangement and location of existing conduits, piping, apparatus, etc., is approximate. The drawings and specifications are for the assistance and guidance of the contractor, exact locations, distances and elevations are governed by actual field conditions. Accuracy of data given herein and on the drawings is not guaranteed. Minor changes may be necessary to accommodate work. The contractor is responsible for verifying existing conditions. Should it be necessary to deviate from the design due to interference with existing conditions or work in progress, claims for additional compensation shall be limited to those for work required by unforeseen conditions as determined by the Architect.
  5. All drawings and divisions of these specifications shall be considered as whole. The contractor shall report any apparent discrepancies to the Architect prior to submitting bids.
  6. The contractor shall be held responsible to have examined the site and compared it with the specifications and plans and to have satisfied himself as to the conditions under which the work is to be performed. He shall be held responsible for knowledge of all existing conditions whether or not accurately described. No subsequent allowance shall be made for any extra expense due to failure to make such examination.

1.06 Closeout Submittals:

- A. Manuals: Furnish manuals for equipment where manuals are specified in the equipment specifications or are specified in Division 01.

1.07 Coordination:

- A. Coordinate the electrical work with the other trades, code authorities, utilities and the Architect.
- B. Provide and install all trenching, backfilling, conduit, pull boxes, splice boxes, etc. for all Utility Company services to the locations indicated on the Drawings. All materials and construction shall be in accordance with the requirements for all the Utility Companies. Prior to performing any work, the Electrical Contractor shall coordinate with the various Utility Companies and obtain utility company engineering drawings. Verify that all such work and materials shown on the Drawings are of sufficient sizes and correctly located to provide services on the site. The Electrical Contractor shall verify with all the Utility Companies that additional contractor furnished and installed work is not required. If additional work, materials, or changes are required by any of the Utility Companies, the Electrical Contractor shall advise the Architect of such changes and no further work shall then be performed until instructed to do so by the Architect. The Electrical Contractor shall coordinate with the various Utility Companies to schedule inspections and to obtain service connections.

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- C. The Electrical Contractor shall schedule all utility work necessary for utility inspections, connections, cable installation, etc. for the new electrical service to meet the construction schedule.
- D. Utility Company charges shall be paid by the Owner.
- E. Contractor shall pay all inspection and other applicable fees and procure all permits necessary for the completion of this work.
- F. Where connections must be made to existing installations, properly schedule all the required work, including the power shutdown periods.
- G. When two trades join together in an area, make certain that no electrical work is omitted.

1.08 Job Conditions:

- A. Operations: Perform all work in compliance with Division 01
  - 1. Keep the number and duration of power shutdown periods to a minimum.
  - 2. Show all proposed shutdowns and their expected duration on the construction schedule. Schedule and carry out shutdowns so as to cause the least disruption to operation of the Owner's facilities.
  - 3. Carry out shutdown only after the schedule has been approved, in writing, by the owner. Submit power interruption schedule 15 days prior to date of interruption.
- B. Construction Power: Unless otherwise noted in Division 01 of these specifications, contractor shall make all arrangements and provide all necessary facilities for temporary construction power [from the owner's on site source. Energy costs shall be paid for by the Owner.
- C. Storage: Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from weather, dust, water, or construction operations.

1.09 Damaged Products:

- A. Notify the Architect in writing in the event that any equipment or material is damaged. Obtain approval from the Architect before making repairs to damaged products.

1.10 Locations:

- A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located.
- B. Dry Locations: All those indoor areas which do not fall within the definition below for Wet Locations and which are not otherwise designated on the Drawings.
- C. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.

1.11 Safety and Indemnity:

- A. The Contractor is solely and completely responsible for conditions of the job site including safety of all persons and property during performance of the work. This requirement will apply continually and not be limited to normal working hours. The contractor shall provide and maintain throughout the work site proper safeguards including, but not limited to, enclosures, barriers, warning signs, lights, etc. to prevent accidental injury to people or damage to property.
- B. No act, service, drawing review or construction review by the Owner, the Engineer or their Consultants is intended to include reviews of the adequacy of the Contractors safety measures in or near the construction site.
- C. The Contractor performing work under this Division of the Specifications shall hold harmless, indemnify, and defend the Owner, the Engineer, their consultants, and each of their officers, agents and employees from any and all liability claims, losses, or damage arising out of or alleged to arise from bodily injury, sickness, or death of a person or persons and for all damages arising out of injury to or destruction of property arising directly or indirectly out of or in connection with the performance of the work under this Division of the Specifications, and from the Contractor's negligence in the performance of the work described in the construction contract documents, but not including liability that may be due to the sole negligence of the Owner, the Engineer, their Consultants or their officers, agents and employees.
- D. If a work area is encountered that contains hazardous materials, the contractor is advised to coordinate with the owner and it's abatement consultant for abatement of hazardous material by the Owner's Representative. "Hazardous materials" means any toxic substance regulated or controlled by OSHA, EPA, State of California or local rules, regulations and laws. Nothing herein shall be construed to create a liability for Aurum Consulting Engineers regarding hazardous materials abatement measures, or discovery of hazardous materials.

1.12 Access Doors:

- A. The contractor shall install access panels as required where floors, walls or ceilings must be penetrated for access to electrical, control, fire alarm or other specified electrical devices. The minimum size panel shall be 14" x 14" in usable opening. Where access by a service person is required, minimum usable opening shall be 18" x 24".
- B. All access doors installed lower than 7'-0" above finished floor and exposed to public access shall have keyed locks.
- C. Where specific information or details relating to access panels differ from Division 26 paragraph 1.12 of these specifications, or shown on the electrical drawings and details or under other Divisions of work, those requirements shall supersede these specifications.

1.13 Arc Flash:

- A. The contractor shall install a clearly visible arc flash warning to the inside door of all panelboards and industrial control panels, as well as to the front of all switchboards and motor control centers that are a part of this project.
- B. The warning shall have the following wording: line 1 "WARNING" (in large letters), line 2 "Potential Arc Flash Hazard" (in medium letters), line 3 & 4 "Appropriate Personal Protective Equipment and Tools required when working on this equipment".

1.14 Emergency Boxes:

- A. All boxes and enclosures for emergency circuits shall be permanently marked with a readily visible red spray painted mark.

PART 2 - PRODUCTS

2.01 Standard of Quality:

- A. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are established to be equal to the specified product and approved by the Architect prior to installation.
- B. Material and Equipment: Provide materials and equipment that are new and are current products of manufacturers regularly engaged in the production of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period includes use of equipment and materials of similar size under similar circumstances. For uniformity, only one manufacturer will be accepted for each type of product.
- C. Service Support: Submit a certified list of qualified permanent service organizations including their addresses and qualification for support of the equipment. These service organizations shall be convenient to the equipment installation and able to render service to the equipment on a regular and emergency basis during the warranty period of the contract.
- D. Manufacturer's Recommendations: Where installation procedures are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendation shall be cause for rejection of the equipment or material.

2.02 Nameplates:

- A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings, the model designation, and shop order number.
- B. Identify each piece of equipment and related controls with a rigid laminated engraved plastic nameplate. Unless otherwise noted, nameplates shall be melamine plastic 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 0.5 by 2.5 inches unless otherwise noted. Where not otherwise specified, lettering shall be a minimum of 0.25 inch high normal block style. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel or brass screws.

2.03 Fasteners:

- A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel.

2.04 Finish requirements:

- A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Architect.
- B. Wiring System: In finished areas, paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed.

PART 3 - EXECUTION

3.01 Workmanship:

- A. Ensure that all equipment and materials fit properly in their installation.
- B. Perform any required work to correct improperly fit installation at no additional expense to the owner.
- C. All electrical equipment and materials shall be installed in a neat and workmanship manner in accordance with the "NECA-1 Standard Practices for Good Workmanship in Electrical Contracting". Workmanship of the entire job shall be first class in every respect.

3.02 Equipment Installations:

- A. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
- B. Do all the cutting and patching necessary for the proper installation of work and repair any damage done.
- C. Earthquake restraints: all electrical equipment, including conduits over 2 inches in diameter, shall be braced or anchored to resist a horizontal force acting in any direction as per CBC Section 1616A Title 24, part 2 and ASCE7-10, Sections 13.3 and 13.6 and Table 13.6-1.
- D. Structural work: All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved by a California registered structural consulting engineer prior to the execution of any construction. At all floor slabs and structural concrete walls to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.

3.03 Field Test:

- A. Test shall be in accordance with Acceptance testing specifications issued by the National Electrical Testing Association (NETA).
- B. Perform equipment field tests and adjustments. Properly calibrate, adjust and operationally check all circuits and components, and demonstrate as ready for service. Make additional calibration and adjustments if it is determined later that the initial adjustments are not satisfactory for proper performance. Perform equipment field test for equipment where equipment field tests are specified in the equipment Specifications. Give sufficient notice to the Architect prior to any test so that the tests may be witnessed.



- C. Provide instruments, other equipment and material required for the tests. These shall be of the type designed for the type of tests to be performed. Test instrument shall be calibrated by a recognized testing laboratory within three months prior to performing tests.
- D. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed and adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions.
- E. Re-testing will be required for all unsatisfactory tests after the equipment or system has been repaired. Re-test all related equipment and systems if required by the Architect. Repair and re-test equipment and systems which have been satisfactorily tested but later fail, until satisfactory performance is obtained.
- F. Maintain records of each test and submit five copies to the Architect when testing is complete. All tests shall be witnessed by the Architect. These records shall include:
  - 1. Name of equipment tested.
  - 2. Date of report.
  - 3. Date of test.
  - 4. Description of test setup.
  - 5. Identification and rating of test equipment.
  - 6. Test results and data.
  - 7. Name of person performing test.
  - 8. Owner or Architect's initials.
- G. Items requiring testing shall be as noted in the additional electrical sections of these specifications.

#### 3.04 Cleaning Equipment:

- A. Thoroughly clean all soiled surfaces of installed equipment and materials.

#### 3.05 Painting of Equipment:

- A. Factory Applied: Electrical equipment shall have factory applied painting system which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical section.
- B. Field Applied: Paint electrical equipment as required to match finish of adjacent surfaces.

#### 3.06 Records:

- A. Maintain one copy of the contract Drawing Sheets on the site of the work for recording the "as built" condition. After completion of the work, the Contractor shall carefully mark the work as actually constructed, revising, deleting and adding to the Drawing Sheets as required. The following requirements shall be complied with:

1. Cable Size and Type: Provide the size and type of each cable installed on project.
2. Substructure: Where the location of all underground conduits, pull boxes, stub ups and etc. where are found to be different than shown, carefully mark the correct location on the Drawings. Work shall be dimensioned from existing improvements.
3. Size of all conduit runs.
4. Routes of concealed conduit runs and conduit runs below grade.
5. Homerun points of all branch circuit.
6. Location of all switchgear, panels, MCC, lighting control panels, pullcans, etc.
7. Changes made as a result of all approved change orders, addendums, or field authorized revisions.
8. As Builds: At the completion of the Work the Contractor shall review, certify, correct and turn over the marked up Drawings to the Architect for his use in preparing "as built" plans.
9. As built Drawings shall be delivered to the Architect within ten (10) days of completion of construction.

### 3.07 Clean Up:

- A. Upon completion of electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Architect.

### 3.08 Mechanical and Plumbing Electrical Work:

- A. The requirements for electrical power and/or devices for all mechanical and plumbing equipment supplied and/or installed under this Contract shall be coordinated and verified with the following:
  1. Mechanical and Plumbing Drawings.
  2. Mechanical and Plumbing sections of these Specifications.
  3. Manufacturers of the Mechanical and Plumbing equipment supplied.
- B. The coordination and verification shall include the voltage, ampacity, phase, location and type of disconnect, control, and connection required. Any changes that are required as a result of this coordination and verification shall be a part of this Contract.
- C. The Electrical Contractor shall furnish and install the following for all mechanical and plumbing equipment:
  1. Line voltage conduit and wiring.
  2. Disconnect switches.
  3. Manual line motor starters.
- D. Automatic line voltage controls and magnetic starters shall be furnished by the Mechanical and/or Plumbing Contractor and installed and connected by the Electrical Contractor. When subcontracted for by the Mechanical and/or Plumbing Contractor, all line voltage control wiring

installed by the Electrical Contractor shall be done per directions from the Mechanical and/or Plumbing Contractor.

- E. All low voltage control wiring for Mechanical and Plumbing equipment shall be installed in conduit. Furnishing, installation and connection of all low voltage conduit, boxes, wiring and controls shall be by the Mechanical and/or Plumbing Contractor.
- F. Disconnects (Motor And Circuit)
  - 1. Disconnect switches shall be as manufactured by ITE- Siemens, General Electric or Square D.
- G. Disconnects (Motor: Fused):
  - 1. Disconnect switches shall be provided and located at all motors.
  - 2. Switches for three-phase motors shall be heavy-duty, horsepower rated three-pole, and surface mounted except as noted on drawings.
  - 3. Switches containing more than three poles shall be as specified on the drawings.
  - 4. Switches for single-phase, fractional horsepower motors shall be heavy-duty, horsepower rated.
  - 5. Switches shall be horsepower rated.
- H. Manual motor starters, where required, shall have toggle type operators with pilot light and melting alloy type overload relays, SQUARE D COMPANY, Class 2510, Type FG-1P (surface) or Type FS-1P (flush) or ITE, WESTINGHOUSE or GENERAL ELECTRIC equal.

END OF SECTION

## **SECTION 26 05 19**

### **LINE VOLTAGE WIRE AND CABLE**

#### **PART 1 - GENERAL**

##### **1.01 Description of Work:**

- A. The work of this Section consists of providing all wire and cable rated 600 volts or less, including splices and terminations, as shown on the Drawings and as described herein.

##### **1.02 Related Work:**

- A. See the following Specification Section for work related to the work in this Section:

- 1. 260542 Conduits, Raceways and Fittings.
- 2. 260533 Junction and Pull Boxes.

##### **1.03 Quality Assurance**

- A. Field tests shall be performed as specified in paragraph 3.04 of this Section.

#### **PART 2 - PRODUCTS**

##### **2.01 Conductors:**

- A. Conductors shall be copper, type THHN/THWN/MTW oil and gasoline resistant, 600 volt rated insulation.
- B. Conductors shall be stranded copper.
- C. Minimum power and control wire size shall be No. 12 AWG unless otherwise noted.
- D. All conductors used on this Project shall be of the same type and conductor material.

##### **2.02 Cables:**

- A. All individual conductors shall be copper with type THHN/THWN, 600 volt rated insulation.
- D. Insulation Marking - All insulated conductors shall be identified with printing colored to contrast with the insulation color.
- E. Color Coding - As specified in paragraph 3.03.
- F. Special Wiring - Where special wiring is proposed by an equipment manufacturer, submit the special wiring requirements to the Owner's Representative and, if approved, provide same. Special wire shall be the type required by the equipment manufacturer.
- G. Other Wiring - Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and as approved by the Owner's Representative.
- H. Manufacturer - Acceptable manufacturers including Cablec, Southwire, or equal.

### 2.03 Terminations:

- A. Manufacturer - Terminals as manufactured by T&B, Burndy or equal.
- B. Wire Terminations – Stranded conductors shall be terminated in clamping type terminations which serve to contain all the strands of the conductor. Curling of a stranded conductor around a screw type terminal is not allowed. For screw type terminations, use a fork type stake-on termination on the stranded conductor. Use only a stake-on tool approved for the fork terminals selected.
- C. End Seals - Heat shrink plastic caps of proper size for the wire on which used.

### 2.04 Tape:

- A. Tape used for terminations and cable marking shall be compatible with the insulation and jacket of the cable and shall be of plastic material.

## PART 3 - EXECUTION

### 3.01 Cable Installation:

- A. Clean Raceways - Clean all raceways prior to installation of cables as specified in Section 260542 - Conduits Raceway and Fittings.
- B. All line voltage wiring shall be installed in conduit.
- C. All feeder conductors shall be continuous from equipment to equipment. Splices in feeders are not permitted unless specifically noted or approved by the Electrical Engineer.
- D. All branch circuit wiring shall be run concealed in ceiling spaces, walls, below floors or in crawl spaces unless noted otherwise.
- E. Cable Pulling - Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.
- F. Bending Radius - Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.
- G. Equipment Grounding Conductors - Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in all conduits or all raceways.
- H. Panelboard Wiring - In panels, bundle incoming wire and cables which are No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

3.02 Cable Terminations and Splices:

- A. Splices - UL Listed wirenuts.
- B. Terminations - Shall comply with the following:
  - 1. Make up and form cable and orient terminals to minimize cable strain and stress on device being terminated on.
  - 2. Burnish oxide from conductor prior to inserting in oxide breaking compound filled terminal.

3.03 Circuit and Conductor Identification:

- A. Color Coding - Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. Conductor colors shall be as follows:

| <u>VOLTAGE</u> | <u>208/120V</u> | <u>480/277V</u> |
|----------------|-----------------|-----------------|
| Phase A        | Black           | Brown           |
| Phase B        | Red             | Orange          |
| Phase C        | Blue            | Yellow          |
| Neutral        | White           | Grey            |
| Ground         | Green           | Green           |

- B. Color coding shall be in the conductor insulation for all conductors #10 AWG and smaller; for larger conductors, color shall be either in the insulation or in colored plastic tape applied at every location where the conductor is readily accessible.
- C. Circuit Identification - All underground distribution and service circuits shall be provided with plastic identification tags in each secondary box and at each termination. Tags shall identify the source transformer of the circuit and the building number(s) serviced by the circuit.

3.04 Field Tests:

- A. All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and ground of not less than the requirements of the CEC. All circuits shall be tested for proper neutral connections.
- B. Insulation Resistance Tests: Perform insulation resistance tests on circuits with #2 AWG and larger conductors to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests before all equipment has been connected. Test the insulation with a 500Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.

END OF SECTION

## **SECTION 26 05 26**

### **GROUNDING**

#### **PART 1 GENERAL**

**1.01 Section Includes:**

- A. Conduits, wires, ground rods and other materials for the electrical grounding system.

**1.02 Related Sections:**

- A. Section 260500 - Electrical General Requirements.

#### **PART 2 PRODUCTS**

**2.01 Ground Rod:**

- A. "Copperweld" ground rod conforming to or exceeding requirements of U.L. Specification No. 467 (ANSI C-33.8). Rod shall be 3/4" diameter and 10' in length, unless otherwise noted on the Drawings.

**2.02 Below Grade Connections:**

- A. Compression fittings, Thomas & Betts, Series 52000, 53000 or 54000 or approved equal.

**2.01 Hardware:**

- A. Bolts, nuts and washers shall be bronze, cadmium plated steel or other non-corrosive materials, approved for the purpose.

**2.04 Waterproof Sealant:**

- A. Use Kearney "Aqua Seal" mastic sealant on all below grade clamp or compression type connections.

#### **PART 3 EXECUTION**

**3.01 Grounding and Bonding:**

- A. Grounding and bonding shall be as required by codes and local authorities.
- B. All electrical equipment shall be grounded, including, but not limited to, panel boards, terminal cabinets and outlet boxes.
- C. The ground pole of receptacles shall be connected to their outlet boxes by means of a copper ground wire connecting to a screw in the back of the box.
- D. A green insulated copper ground wire, sized to comply with codes, shall be installed in all conduit runs.
- E. All metal parts of pull boxes shall be grounded per code requirements.

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- F. All ground conductors shall be green insulated copper.
- G. The ground system electrodes shall be tested for resistance before the equipment ground conductors are connected. Maximum ground system resistance shall be 25 ohms. Install up to two additional ground rods to meet the 25 ohm requirement. Multiple ground rods shall not be less than 10 feet apart.
- H. Grounding of the panels and buildings shall be completed as indicated on the Drawings.

END OF SECTION



**SECTION 26 05 33**

**OUTLET, JUNCTION AND PULL BOXES**

**PART 1 - GENERAL**

**1.01 Description of Work:**

- A. The work of this Section consists of providing all required labor, supervision, materials and equipment to satisfactorily complete all electrical installations shown on the drawings, included in these Specification, or otherwise needed for a complete and fully operating facility. The work shall include but not be limited to the following:
- B. Furnish and install all required material, supports and miscellaneous material for the satisfactory interconnection of all associated electrical systems.

**1.02 Related Work:**

- A. See the following specification sections for work related to the work of this section.
  - 1. 260500 General Electrical Requirements.
  - 2. 260542 Conduits, Raceway and Fittings.
  - 3. 260519 Line Voltage Wire and Cable.

**PART 2 - PRODUCTS**

**2.01 Outlet boxes, Junction and Pull boxes**

- A. Standard Outlet Boxes: Galvanized, steel, knock-out type of size and configuration best suited to the application indicated on the Drawings. Minimum box size shall be 4 inches square (octagon for most light fixtures) by 1-1/2 inches deep with mud rings as required.
- B. Switch boxes: Minimum box size shall be 4 inches square by 1-1/2 inches deep with mud rings as required. Install multiple switches in standard gang boxes with raised device covers suitable for the application indicated.
- C. Conduit bodies: Cadmium plated, cast iron alloy. Conduit bodies with threaded conduit hubs and neoprene gasketed, cast iron covers. Bodies shall be used to facilitate pulling of conductors or to make changes in conduit direction only. Splices are not permitted in conduit bodies. Crouse-Hinds Form 8 Condulets, Appleton Form 35 Unilets or equal.
- D. Sheet Metal Boxes: Use standard outlet or concrete ring boxes wherever possible; otherwise use a minimum 16 gauge galvanized sheet metal, NEMA I box sized to Code requirements with covers secured by cadmium plated machine screws located six inches on centers. Circle AW Products, Hoffman Engineering Company or equal.
- E. Flush Mounted Pull boxes and Junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

### PART 3 - EXECUTION

#### 3.01 Outlet Boxes

##### A. General:

1. All outlet boxes shall finish flush with building walls, ceilings and floors except in mechanical and electrical rooms above accessible ceiling or where exposed work is called for on the Drawings.
2. Install raised device covers (plaster rings) on all switch and receptacle outlet boxes installed in masonry or stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
3. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

##### B. Box Layout:

1. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
2. Locate switch outlet boxes on the latch side of doorways.
3. Outlet boxes shall not be installed back to back nor shall through-wall boxes be permitted. Outlet boxes on opposite sides of a common wall shall be separated horizontally by at least one stud or vertical structural member.
4. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.
5. On fire rated walls, the total face area of the outlet boxes shall not exceed 100 square inches per 100 square feet of wall area.

##### C. Supports:

1. Outlet Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on specified box supports.
2. Fixture outlet boxes installed in suspended ceiling of gypsum board or lath and plaster construction shall be mounted to 16 gauge metal channel bars attached to main ceiling runners.
3. Fixture outlet boxes installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structure above where pendant mounted lighting fixture are to be installed on the box.
4. Fixture Boxes above tile ceilings having exposed suspension systems shall be supported directly from the structure above.
5. Outlet and / or junction boxes shall not be supported by grid or fixture hanger wires at any locations.

### 3.02 Junction And Pull Boxes

#### A. General:

1. Install junction or pull boxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not shown on the Drawings.
2. Locate pull boxes and junction boxes in concealed locations above accessible ceilings or exposed in electrical rooms, utility rooms or storage areas.
3. Install raised covers (plaster rings) on boxes in stud walls or in furred, suspended or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
4. Leave no unused openings in any box. Install close-up plugs as required to seal openings.
5. Identify circuit numbers and panel on cover of junction box with black marker pen.

#### B. Box Layouts:

1. Boxes above hung ceilings having concealed suspension systems shall be located adjacent to openings for removable recessed lighting fixtures.

#### C. Supports:

1. Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on specified box supports.
2. Boxes installed in suspended ceilings of gypsum board or lath and plaster construction shall be mounted to 16 gauge metal channel bars attached to main ceiling runners.
3. Boxes installed in suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structure above.
4. Boxes mounted above suspended acoustical tile ceilings having exposed suspension systems shall be supported directly from the structure above.

END OF SECTION

**SECTION 26 05 42**

**CONDUITS, RACEWAYS AND FITTINGS**

**PART 1 - GENERAL**

**1.01 Description of Work:**

- A. The work of this section consists of furnishing and installing conduits, raceways and fittings as shown on the Drawings and as described herein.

**1.02 Related Work:**

- A. See the following specification sections for work related to the work in this section:
  - 1. 260543 Underground Ducts
  - 2. 260544 In Grade Pull Boxes
  - 3. 260519 Line Voltage Wire and Cable
  - 4. 260533 Junction and Pull Boxes

**PART 2 - PRODUCTS**

**2.01 Conduits, Raceways:**

- A. Electrical Metallic Tubing (EMT) shall be hot-dip galvanized after fabrication. Couplings shall be compression or set-screw type.
- B. Flexible Conduit: Flexible metal conduit shall be galvanized steel.
- C. Galvanized Rigid Steel Conduit (GRS) shall be hot-dip galvanized after fabrication. Couplings shall be threaded type.
- D. Rigid Non-metallic Conduit: Rigid non-metallic conduit shall be PVC Schedule 40 (PVC-40 or NEMA Type EPC-40) conduit approved for underground use and for use with 90° C wires.

**2.02 Conduit Supports:**

- A. Supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer.
- B. Supports for multiple conduits shall be hot-dipped galvanized Unistrut or Superstrut channels, or approved equal. All associated hardware shall be hot-dip galvanized.
- C. Supports for EMT conduits shall be galvanized pressed steel single hole straps.
- D. Clamp fasteners shall be by wedge anchors. Shot in anchors shall not be allowed.

**2.03 Fittings:**

- A. Provide threaded-type couplings and connectors for rigid steel conduits; provide steel compression (watertight), or steel set-screw type for EMT, (die-cast zinc or malleable iron type fittings are not allowed). Provide threaded couplings and Meyers hubs for rigid steel conduit exposed to weather.
- B. Fittings for flexible conduit shall be Appleton, Chicago, IL, Type ST, O-Z Gedney Series 4Q by General Signal Corp., Terryville, CT, T & B 5300 series, or approved equal.
- C. Fittings for use with rigid steel shall be galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse Hinds Condulets, Syracuse, NY, Appleton Unilets, Chicago, IL, or approved equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.
- D. Fittings for use with rigid non-metallic conduit shall be PVC and have solvent-weld-type conduit connections.
- E. Union couplings for conduits shall be the Erickson type and shall be Appleton, Chicago, IL, Type EC, O-Z Gedney 3-piece Series 4 by General Signal Corp., Terryville, CT, or approved equal. Threadless coupling shall not be used.
- F. Bushings:
  - 1. Bushings shall be the insulated type.
  - 2. Bushings for rigid steel shall be insulated grounding type, O-Z Gedney Type HBLG, Appleton Type GIB, or approved equal.
- G. Conduit Sealants:
  - 1. Fire Retardant Types: Fire stop material shall be reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL Classification 35L4 or as specified on the Drawings.

### PART 3 - EXECUTION

#### 3.01 Conduit, Raceway and Fitting Installation:

- A. For conduit runs exposed to weather provide rigid metal (GRS).
- B. For conduit run underground, in concrete or masonry block wall and under concrete slabs, install minimum 3/4" size nonmetallic (PVC) with PVC elbows. Where conduits transition from underground or under slab to above grade install wrapped rigid metal (GRS) elbows and risers.
- C. For conduit runs concealed in steel or wood framed walls or in ceiling spaces or exposed in interior spaces above six feet over the finished floor, install EMT.
- D. Flexible metal conduit shall be used only for the connection of recessed lighting fixtures and motor connections unless otherwise noted on the Drawings. Liquid-tight steel flexible conduit shall be used for motor connections.
- E. The minimum size raceway shall be 1/2-inch unless indicated otherwise on the Drawings.
- F. Installation shall comply with the CEC.

- G. From pull point to pull point, the sum of the angles of all of the bends and offset shall not exceed 360 degrees.
- H. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits concealed except where otherwise shown on the drawings.
  - 1. Exposed Conduits: Support exposed conduits within three feet of any equipment or device and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps.
    - a. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel or at right angles to building lines.
    - b. Group exposed conduits together. Arrange such conduits uniformly and neatly.
  - 2. Support all conduits within three feet of any junction box, coupling, bend or fixture.
  - 3. Support conduit risers in shafts with Unistrut Superstrut, or approved equal, channels and straps.
- I. Moisture Seals: Provide in accordance with NEC paragraphs 230-8 and 300-5(g).
- J. Where PVC conduit transitions from underground to above grade, provide rigid steel 90's with risers. Rigid steel shall be half-lap wrapped with 20 mil tape and extend minimum 12" above grade.
- K. Provide a nylon pull cord in each empty raceway.
- L. Provide galvanized rigid steel factory fittings for galvanized rigid steel conduit.
- M. Slope all underground raceways to provide drainage; for example, slope conduit from equipment located inside a building to the pull box or manhole located outside the building.
- N. Conduits shall be blown out and swabbed prior to pulling wires, or installation of pull cord in empty conduits.

END OF SECTION

## SECTION 26 05 50

### THROUGH-PENETRATION FIRESTOPPING FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 Related Documents:

- A. Drawings and Division 0 Specification Section, apply to work specified in this section.

##### 1.2 Definitions:

- A. Firestopping: The process of restoring an hourly fire endurance rating back to a fire barrier that lost its rating from an opening created in it.

##### 1.3 General Description of the Work of This Section:

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

##### 1.4 Related Work of Other Sections:

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including (if available):
  - 1. Section 033000 - Cast-In-Place Concrete
  - 2. Section 092116 - Gypsum Drywall Systems
  - 3. Section 260500 - General Electrical Requirements
  - 4. Section 104400 - Fire Protection Specialties

##### 1.5 References:

- A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).
- B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Through-Penetration Firestop Devices (XHCR)
    - b. Fire Resistance Ratings (BXUV)
    - c. Through-Penetration Firestop Systems (XHEZ)
    - d. Fill, Voids, or Cavity Material (XHHW)
    - e. Forming Materials (XHKU)
- C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- D. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

- E. All major building codes: ICBO, SBCCI, BOCA, and IBC.  
(Note to specifier: Retain or delete building codes listed above as applicable)

- F. NFPA 101 - Life Safety Code

1.6 Quality Assurance:

- A. Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- B. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- C. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

1.7 Project Conditions :

- A. Do not use materials that contain flammable solvents.
- B. Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- C. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.
- D. Scheduling
  - 1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
  - 2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- E. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- F. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.1 Firestopping, General:

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.



- C. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.

## 2.2 Acceptable Manufacturers:

- A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
  - 1. Specified Technologies Inc., STI  
800-992-1180
  - 2. Hilti, Inc., Tulsa, Oklahoma  
800-879-8000
  - 3. Other manufacturers listed in the U.L. Fire Resistance Directory – Volume 2

## 2.3 Materials:

- A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Cast-in place firestop devices: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket. Cast-in Place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems), or electrical cable bundles, penetrating concrete floors, the following products are acceptable:
  - 1. Specified Technologies, Inc. (STI) SpecSeal CD Cast-In Firestop Device
  - 2. Hilti CP 680 Cast-In Place Firestop Device
  - 3. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- C. Latex Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture. Latex Sealants for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant
  - 2. Specified Technologies, Inc. (STI) SpecSeal Series LCI Intumescent Sealant
  - 3. Specified Technologies, Inc. (STI) SpecSeal Series LC Endothermic Sealant
  - 4. Hilti FS-ONE Intumescent Firestop Sealant
  - 5. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- D. Intumescent Latex sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture. Intumescent Latex Sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
  - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant
  - 2. Specified Technologies, Inc. (STI) SpecSeal Series LCI Intumescent Sealant
  - 3. Hilti FS-ONE Intumescent Firestop Sealant
  - 4. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- E. Intumescent sealants, foams, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant

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2. Specified Technologies, Inc. (STI) SpecSeal Series LCI Intumescent Sealant
  3. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty
  4. Specified Technologies, Inc. (STI) Ready Firestop Grommet
  5. Hilti FS-ONE Intumescent Firestop Sealant
  6. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- F. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty
  2. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- G. Wall opening protective materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24". Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
1. Specified Technologies, Inc. (STI) SpecSeal Series SSP Firestop Putty Pads
  2. Specified Technologies, Inc. (STI) SpecSeal Series EP PowerShield Insert Pads
  3. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 1
- H. Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Specified Technologies, Inc. (STI) SpecSeal Series SSM Firestop Mortar
  2. Specified Technologies, Inc. (STI) SpecSeal Series SSB Firestop Pillows
  3. Hilti FS 635 Trowelable Firestop Compound
  4. Hilti FS 657 FIRE BLOCK
  5. Hilti CP 620 Fire Foam
  6. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- I. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
1. Specified Technologies, Inc. (STI) SpecSeal Series SSB Firestop Pillows
  2. Hilti FS 657 FIRE BLOCK
  3. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
- J. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway
- K. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

## PART 3 - EXECUTION

### 3.1 Preparation:

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
  - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

3.2 Coordination:

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

3.3 Installation:

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.
  - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - 2. Protect materials from damage on surfaces subjected to traffic.

3.4 Field Quality Control:

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 Adjusting and Cleaning:

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

**SECTION 26 24 16**

**PANELBOARDS AND DISTRIBUTION PANELS**

**PART 1 – GENERAL**

**1.01 Description of Work:**

- A. The work of this Section consists of providing panelboards and circuit breakers as shown on the Drawings and as described herein.

**1.02 Related Work:**

- A. See the following specification sections for work related to the work in this Section.

- 1. 260519 Line Voltage Wire and Cable
- 2. 260526 Grounding
- 3. 262816 Circuit Breakers

**1.03 Submittals:**

- A. Shop Drawings - As specified in Division 01 and Section 260500. For each panelboard and distribution panel furnished under this Contract, submit manufacturer's name, catalog data, and the following information:
  - 1. Panelboard / distribution panel type.
  - 2. Main bus and terminal connection sizes.
  - 3. Location of line connections.
  - 4. Cabinet dimension.
  - 5. Gutter space.
  - 6. Gauge of boxes and fronts.
  - 7. Finish data.
  - 8. Voltage rating.
  - 9. Breaker manufacturer, types, trip rating, and interrupting ratings.
  - 10. When information is available on the Drawings, show breaker circuit numbers and locations along with trip ratings on a panelboard layout.
- B. Single Submittal - A single complete submittal is required for all products covered by this Section.
- C. Closeout Submittals: Submit operation and maintenance data for panelboards and circuit breakers including nameplate data, parts lists, factory and field test reports, recommended maintenance procedures and typewritten as-built panel schedules. Submit in accordance with Division 01.

## PART 2 – PRODUCTS

### 2.01 Panelboards:

- A. General: Lighting and Receptacle Panelboards shall be the automatic circuit breaker type. The number and arrangement of circuits, trip ratings, spares and blank spaces for future circuit breakers shall be as shown on the Drawings or, if not shown, 42 circuits. All circuit breakers shall be quick-make, quick-break, thermal-magnetic, bolt-on type (unless otherwise noted on drawings), with 1, 2 or 3 poles as shown, each with a single operating handle. Tandem or piggy-back breakers shall not be used.
- B. Nameplates:
  - 1. Each panelboard shall have a field mounted identifying, rigid, plastic nameplate giving the panel identification as shown on the Drawings.
  - 2. Each panelboard shall have a manufacturer's nameplate showing the voltage, bus rating, number of phases, frequency and number of wires.
- C. Construction:
  - 1. Door and trim shall be finished to match finish type and color of surrounding wall. Box shall be hot-dip galvanized, field finished to match the front.
  - 2. Panelboards and enclosures shall conform to requirements of all relevant codes. Panelboards shall be suitable for use as service equipment.
  - 3. Panelboards shall be furnished with hinged trim fronts with key latch and a typed directory card and holder. Panelboard circuits shall be arranged with odd numbers on the left and even numbers on the right. Provide weatherproof, NEMA type 3R enclosures for outdoor installation.
- D. Busbars: Panelboard busbars shall be phase sequence type suitable for bolt-on circuit breakers. All busbars shall be copper.
- E. Circuit Breakers: Circuit breakers shall be the molded case type with trip and interrupting ratings as shown on the Drawings.
- F. Manufacturer:
  - 1. Panelboard manufacturer shall be Square D, or Siemens, or I.E.M , or General Electric, or Eaton Cutler Hammer. Panelboards shall be of the same manufacturer as the switchboard.

### 2.02 Distribution Panels:

- A. General: Distribution panels shall be the automatic circuit breaker type. The number and arrangement of circuits, trip ratings, spares and blank spaces for future circuit breakers shall be as shown on the Drawings. All circuit breakers shall be quick-make, quick-break, thermal-magnetic bolt-on type, with 1, 2 or 3 poles as shown, each with a single operating handle. Tandem or piggy-back breakers shall not be used.
- B. Nameplates:

1. Each distribution panel shall have a field mounted, identifying, rigid, plastic nameplate giving the panel identification as shown on the Drawings.
2. Each distribution panel shall have a manufacturer's nameplate showing the voltage, bus rating, number of phases, frequency and number of wires.

C. Construction:

1. Door and trim shall be finished to match color of surrounding wall. Box shall be hot-dip galvanized, field finished to match the front.
2. Distribution panels and enclosures shall conform to requirements of all relevant codes. Distribution panels shall be suitable for use as service.
3. Distribution panels shall have a front door with key latch and a typed directory card and permanently attached holder. Adhesive backed holders are not acceptable. Distribution panels circuits shall be arranged with odd numbers on the left and even numbers on the right. Provide weatherproof, NEMA type 3R enclosures for outdoor installation.

D. Busbars: Distribution panels busbars shall be phase sequence type suitable for bolt-on circuit breakers. All busbars shall be copper, sized for a maximum current density of 1000A psi.

E. Circuit Breakers: Circuit breakers shall be the molded case type with trip and interrupting ratings as shown on the Drawings.

F. Manufacturer:

1. Distribution panel manufacturer shall be Square D, or Siemens, or I.E.M., or General Electric, or Eaton Cutler Hammer. Distribution panels shall be of the same manufacturer as the switchboard.

### PART 3 – EXECUTION

3.01 Installation: Panelboards and Distribution Panels shall be installed where indicated on the Drawings, and in accordance with the manufacturer's instructions.

3.02 Mounting:

- A. Panelboards and Distribution Panels shall be mounted with the top of the box 6'-6" above the floor. Panelboards and Distribution Panels shall be plumb within 1/8-inch. The highest breaker operating handle shall not be higher than 72 inches above the floor.

3.03 Field Tests:

- A. Insulation Resistance Tests: Perform insulation resistance tests on circuits with #2 AWG and larger conductors to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. Test the insulation with a 500Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 2 megohms or more. Submit results for review.
- B. Grounding: Grounding shall conform to Section 260526.
- C. Continuity: Panelboard and Distribution Panel circuits shall be tested for continuity prior to energizing. Continuity tests shall be conducted using a dc device with a bell or buzzer.

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END OF SECTION

## **SECTION 26 27 26**

### **DEVICES WIRING**

#### **PART 1 – GENERAL**

##### **1.1 DESCRIPTION OF WORK**

- A. The work of this section consists of:
  - 1. Furnishing, installing, and connecting all duplex receptacles complete with wall plates and/or covers, as shown on the Drawings.
  - 2. Furnishing, installing and connecting all light switches complete with wall plates and or handle operators, as shown on the Drawings.

##### **1.2 RELATED WORK**

- A. See the following specification sections for work related to the work of this section:
  - 1. 260542 Conduits, Raceways and Fittings.
  - 2. 260519 Line Voltage Wire and Cable.
  - 3. 260533 Junction and Pull Boxes.

##### **1.3 SUBMITTALS: As specified in Section 260500 and Division 01.**

- A. Submit manufacturers published descriptive literature properly marked to identify the items to be supplied.
- B. A single complete submittal is required for all products covered by this Section.

#### **PART 2 – PRODUCTS**

##### **2.1 RECEPTACLES**

- A. General - Receptacles shall be heavy duty, high abuse, grounding type.
- B. Duplex Receptacles:
  - 1. Receptacles shall be specification grade, rated 20 ampere, two-pole, 3-wire, 125 volt, NEMA 5-20 configuration, self-grounding with screw terminals. Color shall be as selected by the Owner.
  - 2. Devices shall have a nylon face, back and side wired.
  - 3. Manufacturer: Hubbell #DR20 Series, Leviton #16352.
- C. GFCI Receptacles:
  - 1. Device shall be rated 20 ampere, 2-pole, 3-wire, 120 volt, conforming to NEMA 5-20 configuration. Face shall be nylon composition. Unit shall have an LED type red indicator light, test and reset push buttons. Color shall be as selected by the Architect.



2. GFCI component shall meet UL 943 Class A standards with a tripping time of 1/40 second at 5 milliamperes current unbalance. Operating range shall extend from -31 F to 158 F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.

3. Manufacturer: Hubbell #GF20\_\_LA Series, Leviton #7899 Series.

D. Weather Resistant GFCI Receptacles:

1. Device shall be rated 20 ampere, 2-pole, 3-wire, 120 volt, conforming to NEMA 5-20 configuration, Face shall be nylon composition. Unit shall have a LED type red indicator light, test and reset push buttons. Color shall be as selected by the architect.
2. GFCI component shall meet UL 943 Class A standards with a tripping time of 1/40 second at 5 milliamperes current unbalance. Operating range shall extend from -31 F to 158 F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.

3. Manufacturer: Hubbell #GFTR20\_\_ Series, Leviton # W7899-TR Series.

## 2.2 SWITCHES

- A. Switches shall be rated 20 amperes to 120/277 volts ac. Units shall be flush mounted, self-grounding, quiet operating rocker devices. Rocker color shall be as selected by the Architect.
  1. Manufacturer: Hubbell #DS\_20\_\_ Series, Leviton #5621 Series. See plans for single pole, three way and four way requirements.
- B. Timed switches: Shall be as designed by Paragon Electric Company # ET2000f or Watt Stopper TS-200 rated for the voltage specified on drawings. Time-out shall be adjustable from 5 minutes up to 12 hours. Unit shall be provided with warning alarm.
- C. Dimmer switches: Switch shall be as specified on drawings, color per architect. Heat fins shall not be removed, where dimmer switches are ganged together, care shall be taken to install correct size backbox to accommodate switches without removing fins.

## 2.3 PLATES

- A. General - Plates shall be of the style and color to match the wiring devices, and of the required number of gangs. Plates shall conform with NEMA WD 1, UL 514 and FS W-P-455A. Plates on finished walls shall be non-metallic or stainless steel. Plates on unfinished walls and on fittings shall be of zinc plated steel or case metal and shall have rounded corners and beveled edges.
- B. Non-Metallic: Plates shall be plain with beveled edges and shall be nylon or reinforced fiberglass.
- C. Stainless Steel: Plates shall be .040 inches thick with beveled edges and shall be manufactured from No. 430 alloy having a brushed or satin finish.
- D. Cast Metal: Plates shall be cast or malleable iron covers with gaskets so as to be moisture resistant or weatherproof.

- E. Blank Plates: Cover plates for future telephone outlets shall match adjacent device wall plates in appearance and construction.
- F. Weatherproof Plate: Cover plates in wet and damp locations shall have recessed in-use covers, Taymac or equal. Back box shall be suitable for the wall material where it is installed.
- G. Labeling: All switch and receptacle plates shall be labeled on the top portion of the plate with the panelboard and circuit number serving that device. Lettering shall be 3/16" minimum high, black color, on clear Mylar 3/8" tape. Manufactured by P-touch or equal.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION OF WIRING DEVICES

- A. Interior Locations: In finished walls, install each device in a flush mounted box with washers as required to bring the device mounting strap level with the surface of the finished wall. On unfinished walls, surface mount boxes level and plumb.
- B. Mounting Heights: Adjust boxes so that the front edge of the box shall not be farther back from the finished wall plane than 1/4-inch. Adjust boxes so that they do not project beyond the finished wall. Height of device shall be as follows unless otherwise noted on the drawings:
  - 1. Receptacles                      15 Inches from finished floor to bottom of box.
  - 2. Toggle Switches                48 Inches from finished floor to top of box.
- C. Receptacles:
  - 1. Ground each receptacle using a grounding conductor, not a yoke or screw contact.
  - 2. Install receptacles with connections spliced to the branch circuit wiring in such a way that removal of the receptacle will not disrupt neutral continuity and branch circuit power will not be lost to other receptacles in the same circuit.

#### 3.2 INSTALLATION OF WALL PLATES

- A. General - Plates shall match the style of the device and shall be plumb within 1/16-inch of the vertical or horizontal.
- B. Interior Locations, Finished Walls: Install non-metallic plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Do not use oversized plates or sectional plates.
- C. Interior (not wet) Locations, Unfinished Walls: Install stainless steel or cast metal cover plates.
- D. Wet Locations: Install cast metal plates with gaskets on wiring devices in such a manner as to provide a rain tight weatherproof installation. Cover shall be [lockable] outdoor "in use" type.
- E. Future Locations: Install blanking cover plates on all unused outlets.

#### 3.3 TESTS

- A. Receptacles:

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1. After installation of receptacles, energize circuits and test each receptacle to detect lack of ground continuity, reversed polarity, and open neutral condition.

END OF SECTION 262726

## **SECTION 26 28 16**

### **CIRCUIT BREAKERS**

#### **PART 1 - GENERAL**

##### **1.01 Description of Work:**

- A. The work of this Section consists of providing circuit breakers as shown on the Drawings and as described herein.

##### **1.02 Related Work:** See the following Specification Sections for work related to the work in this Section.

- A. 260500      General Electrical Requirements
- B. 262413      Switchboards
- C. 262416      Panelboards and Distribution Panels

##### **1.03 Submittals:**

- A. Shop Drawings - Submittals shall be in accordance with Section 260500 and Division 01. For each circuit breaker furnished under this Contract, submit manufacturer's name, catalog data, and the following information:
  - 1. Terminal connection sizes.
  - 2. Voltage rating.
  - 3. Breaker manufacturer, types, trip ratings and interrupting ratings.
- B. Single Submittal - A single complete submittal is required for all products covered by this Section.
- C. Closeout Submittals: Submit in accordance with and Section 260500, operation and maintenance data for circuit breakers including nameplate data, parts lists, manufacturer's circuit breaker timer, current, coordination curves, factory and field test reports and recommended maintenance procedures.

#### **PART 2 - PRODUCTS**

##### **2.01 Circuit Breaker:** Each circuit breaker shall consist of the following:

- A. A molded case breaker with an over center toggle-type mechanism, providing quick-make, quick-break action. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Multipole circuit breakers shall have variable magnetic trip elements which are set by a single adjustment to assure uniform tripping characteristics in each pole. Circuit breakers shall be of the bolt-on type unless otherwise noted.
- B. Breaker shall be calibrated for operation in an ambient temperature of 40 C.
- C. Each circuit breaker shall have trip indication by handle position and shall be trip-free.

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- D. Three pole breakers shall be common trip.
- E. The circuit breakers shall be constructed to accommodate the supply connection at either end of the circuit breaker. Circuit breaker shall be suitable for mounting and operation in any position.
- F. Breakers shall be rated as shown on Drawings.
- G. Circuit breaker and/or Fuse/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations for use in the end use equipment in which it is installed. Any series rated combination used shall be marked on the end use equipment per CEC section 110-22.
- H. Breakers shall be UL listed. Circuit breakers shall have removable lugs.
- I. Lugs shall be UL listed for copper and aluminum conductors.
- J. Breakers shall be UL listed for installation of mechanical screw type lugs.
- K. Circuit breakers serving HACR rated loads shall be HACR type. Circuit breakers serving other motor loads shall be motor rated.

### PART 3 - EXECUTION

#### 3.01 Mounting:

- A. The highest breaker operating handle shall not be higher than 72 inches above the floor.

END OF SECTION

**SECTION 283100**

**FIRE ALARM SYSTEM**

**PART 1 - GENERAL**

**1.01 Description of Work:**

- A. Furnish and install all materials and equipment including all required equipment, panels, raceways, conductors and connections. Provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 26 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for the extension of the existing addressable fire alarm system installation including all accessories and appurtenances required for testing the systems. It is in the intent of the drawings and specifications that all systems will be complete, and ready for operation. No extra charge will be paid for furnishing items required by regulations, but not specified herein, or on drawings.
- B. The contractor scope of work shall not degrade any function or operation of the remaining site fire alarm system.

**1.02 Related work:**

- A. Division 00 General Conditions, Division 01 General Requirements.
- B. See the following specification sections for work related to the work in this section.
  - 1. All other sections of Division 26.

**1.03 Codes and Standards:**

- A. Devices and equipment for fire alarm systems shall be U.L. listed.
- B. UL 864 Control Units, Fire Protective Signaling Systems.
- C. Devices and equipment for fire alarm system shall be listed by the California State Fire Marshal for the specific purpose the device or equipment is used.
- D. Work and material shall be in compliance with and according to the requirements of the latest version of the following standards and codes:
  - 1. California Fire Code (CFC) based on the International Fire Code (IFC) with California Amendments.
  - 2. California Building Code (CBC) based on the International Building Code (IBC) with California Amendments.
  - 3. California Electric Code (CEC) based on the National Electric Code (NEC) and California Amendments.

4. California Mechanical Code (CMC) based on the Uniform Mechanical Code (UMC) and California Amendments.
5. California Plumbing Code (CPC) based on the Uniform Plumbing Code (UPC) and California Amendments.
6. Title 19 C.C.R., Public Safety, State Fire Marshals Regulations.
7. NFPA 72, National Fire Alarm and Signaling Code.

1.04 Submittals:

- A. In accordance with Division 26.
- B. Submit the following items:
  1. Manufacturer's Catalog Data: Manufacturer's original catalog cuts and original description of data of all material and equipment with sufficient information provided so that the exact function of each device is known. Each item supplied shall be clearly identified including both U.L. number and a copy of the State Fire Marshal's listing.
- C. Description of conductors to be used with a statement that all wire shall be in conduit. Where accessible ceiling occurs, plenum rated wire on J-hooks are acceptable.

1.05 Quality Assurance:

- A. Installer: The installation firm shall be an established communications and electronics contractor with at least 10 years successful installation experience of products utilizing integrated communications systems and equipment specific to that required for this project. The firm shall currently maintain and locally run and operated business. Only California Certified fire alarm technicians or California Certified electrician shall be used to install the fire alarm system. Provide proof to district that all employees are California Certified to install the fire alarm system.
- B. All materials, unless otherwise specified, shall be new, and free from any defects. All items of equipment including wire and cable shall be designed by the manufacturer unless otherwise specified, shall function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.
- C. The Contractor shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

1.06 Warranties:

- A. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defect for one year (365 days) from the date of final acceptance. The contractor shall without

additional expense to the owner, replace any defective materials or equipment provided by him under this contract within the warranty period.

## PART 2 – PRODUCTS

### 2.01 Fire Alarm Control Panel:

- A. The FACP is existing to remain.

### 2.02 Detection Devices:

#### A. Manual Pull Stations:

1. Provide non coded, addressable, semi-recessed, double-action type manual pull station with mechanical reset features. Where installed in existing buildings, boxes may be surface-mounted. Surface mounted boxes shall be the same color as the pull stations.
2. Provide separate screw terminal for each conductor connected to the manual alarm pull station. Break-glass-front pull stations will not be permitted. Provide red aluminum, housing labeled "fire". The pull stations shall not be resettable without the use of a key. [Provide Stopper II Guards for all manual stations in public areas].

#### B. Detectors:

1. Each photoelectric smoke detector and heat detector shall be interchangeable via twist-lock mounting base, to ensure matching the proper sensor to the potential hazards of the areas being protected. The system shall recognize when an improper sensor type has been installed in a previously programmed sensor type location.

#### C. Photoelectric Smoke Detector:

1. Provide white flame retardant plastic, addressable, analog, photoelectric type, smoke detectors. Detectors shall operate using an optical sensing chamber principal which complies with UL 268.
2. Each detector shall be capable of being set at two sensitivity settings.
3. Each detector shall have two LED visual indicators providing local 360 degree visibility of operating status and alarm indication.
4. Each detector shall be supported independently of wiring connections, and connected by separate screw terminals of each conductor.
5. The detector screen and cover assembly must be easily removable for field cleaning.

#### D. Combination Fixed Temperature, rate of Rise Heat Detectors:



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1. Provide off-white flame retardant plastic, addressable, combination 140 degree F fixed temperature, rate of rise heat dual thermistor detectors. Detector shall initiate an alarm when temperature rises at a rate of over 15 degrees F per minute or above 140 degrees F.
  2. Each detector shall have two LED visual indicators providing local 360 degree visibility of operating status and alarm indication.
  3. Contacts shall be self-resetting after response to rate or rise principal. Locate detectors in accordance with UL FPD or FM P7825 listing and the requirements of NFPA 72. Temperature rating of detectors shall be in accordance with NFPA 72.
- E. Addressable Monitor Module: provide addressable monitor module wired as style B (class "B") to provide an address for normally open contact devices.
1. Provide Addressable Monitor Module to monitor status of all Water flow Switches, Valve tamper Switches and Post Indicator Valves.
- A. Field Charging Power Supply (FCPS):
1. The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
  2. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby. Upgrade batteries as shown on drawings and include any necessary housing/mounting cabinet necessary for upsized batteries.
  3. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
  4. The FCPS shall include an attractive surface mount backbox.
  5. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
  6. The FCPS include power limited circuitry, per 1995 UL standards.

2.03 Wiring and Conduit:

- A. Provide wiring in accordance with NFPA 72.
- B. Conductors shall be solid copper. Conductors for 120 volt circuits shall be No. 12 AWG minimum; conductors for low-voltage DC circuits shall be No. 14 AWG minimum for annunciation circuits and No. 14 AWG minimum for initiation circuits. All cables shall be rated and code compliant for their use.
1. All low voltage wiring not installed in conduits shall be plenum rated.

2. Provide color-coded conductors. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Each conductor used for the same specific function shall be distinctly color coded. Use different color codes for each interior circuit. Each circuit color code wire shall remain uniform throughout the circuit.
3. Pigtail or "T" tap connections to the evacuation alarm horns, horn/strobes and strobes are not acceptable.
4. Underground circuit or circuits in wet areas shall be gel filled cables in scheduled 40 PVC conduit. There shall be no splicing of any underground cables.

C. Conduits:

1. Identification of Conduit: New conduits containing fire alarm system conductors shall be [red],  $\frac{3}{4}$ " minimum. Junction-boxes, covers, gutters, and terminal cabinets, containing fire alarm system conductors, shall be painted red or provided red in color with engraved plastic identification signs permanently attached to the equipment.
2. Do not run fire alarm circuits in the same conduit with the non-fire alarm circuits.
3. Do not run AC circuits in the same conduit with the fire alarm circuits.
4. Provide wiring in rigid metal conduit for exterior installations or where exposed to damage.
5. Conceal conduit in finished areas of new construction and wherever practical in existing construction. Conduit runs shall be straight, neatly arranged properly supported and parallel or perpendicular to walls and partitions. Identify conductors within each enclosure where a tap, splice, or termination is made.

PART 3 - EXECUTION

3.01 Installation:

- A. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with the NFPA publications and as modified herein.
- B. Follow manufacturer's directions in all cases for installation, testing and energizing.
- C. Accurately set, level, support, and fasten all equipment.
- D. Smoke and heat detectors:
  1. No detector shall be located closer than 12 inches to any part of any lighting fixture. Detectors, located in areas subject to moisture or exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be approved for such locations.

- E. Conduit where exposed shall be installed parallel with the walls or structural elements; vertical runs to be plumb; horizontal runs to be level or parallel with structure; conduit grouped neatly together with straight runs, all bends parallel and uniformly spaced.
- F. Earthquake Resistant installation/fastening of all electrical equipment shall conform to the general requirements of section 1614A of the California Building Code.

### 3.02 Preliminary Tests:

- A. Conduct the following tests during installation of wiring and system components. Correct deficiency pertaining to these requirements prior to formal functional and operational tests of the system, preliminary tests shall be performed in the presence of the Local Fire Authority and Project inspector of Record to determine the conformance with the specified requirements.
- B. Ground Resistance: Measure the resistance of each connection to ground. Ground resistance shall not exceed 10 ohms.
- C. Dielectric Strength insulation Resistance: Test the dielectric strength and the Insulating resistance of the system interconnecting wiring by means of an instrument capable of generating 500 volts of DC and equipped to indicate leakage current 1000 megohms. For the purpose of this test, connect the instrument between each conductor on the line and between each conductor and ground at the control panel end of the line, with the other extremity open circuited and all series-connected devices in place. The system shall withstand the test without breakdown and shall indicate a resistance of not less than 1.0 minute with a DC potential of not less than 100 volts and not more than 500 volts.
- D. Standby Battery Test: prior to formal inspection and tests, place the fire alarm system on standby battery power for 24 hours; immediately thereafter, sound the building evacuation alarm signaling devices for 5 minutes. When the test is complete, the fire alarm system battery charger shall be fully recharged within 24 hours.
- E. Field Inspection and Test:
  - 1. Before final acceptance of the work, pre-test system to demonstrate compliance with the contract requirements. System shall be subjected to complete functional and operational tests, including tests in place of each detector. When tests have been completed and corrections made, submit a signed and dated NFPA Certificate of Completion along with a completed testing matrix with the request for formal inspection and tests.
  - 2. Where application of heat would destroy a heat detector, it may be manually activated.
  - 3. Verify the proper receipt of the alarm signals at the central station for the UDACT provide printout of test reports. It shall be the sole obligation of the contractor to coordinate and to provide all testing documentation from the central station.
  - 4. The communication loops and the indicating appliance circuits shall be opened in at least two locations per zone to check for the presence of correct supervisory circuitry.

5. Perform the field inspection and test in the presence of the manufacturer's representative, the owner's representative, local Fire Authority and Project Inspector of Record (IOR).
6. Test equipment: It shall be the responsibility of the installing Contractor to furnish tools, instruments, and materials required for a thorough test of the system. This includes, but is not limited to, the following:
  - a. VOM meter
  - b. Manufacturer's recommended smoke detector testing device and sensitivity test equipment.
  - c. Heat source for testing heat detectors.
  - d. Keys to all control panels.
  - e. Ladders

### 3.03 Project Closeout:

#### A. As Built Drawings:

1. Provide a complete set (full size scalable) of reproducible "as-built" and AutoCAD format drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment upon completion of system.

#### B. Operating and Instruction Manuals:

1. Operating and Instruction manuals shall be submitted prior to testing of the system. Four complete sets of operation and instructions manuals shall be delivered to the owner upon request.
2. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and troubleshooting manual explaining how to test the preliminary internal parts or each piece of equipment shall be delivered upon completion of the system.

#### C. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:

1. Instructions on replacing any components of the system, including internal parts.
2. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions.
3. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.

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4. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION